OKI MICROLINE 393

MAINTENANCE MANUAL

PREFACE

This maintenance manual describes how to maintain the Microline 393 printer in the field.

This manual is for customer engineers.

For further information, refer to the User's Manual for handling or operating the equipment.

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1. CONFIGURATION

1. CONFIGURATION

1.1 Standard Configuration

ML393 consists of the following assemblies:

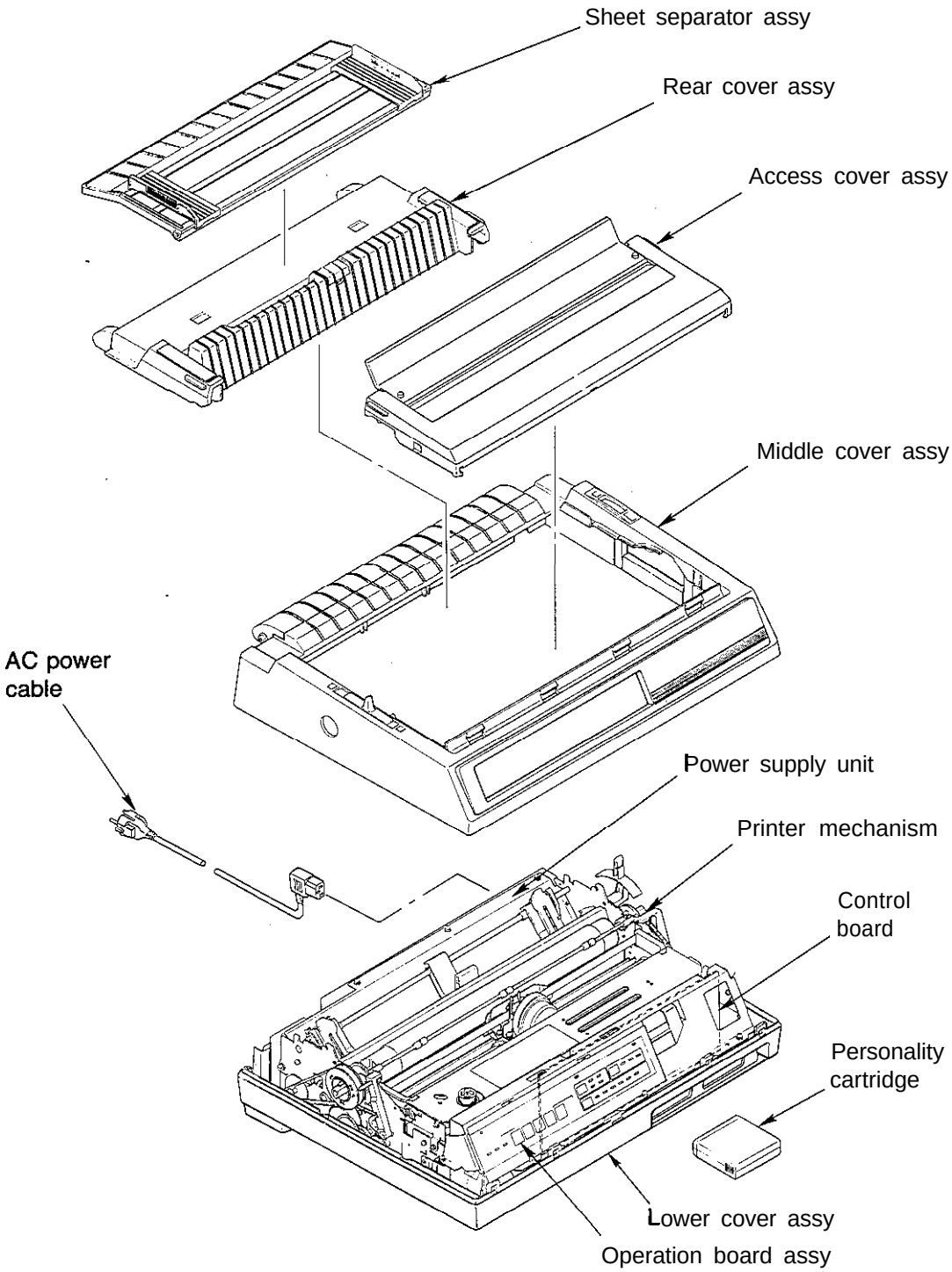
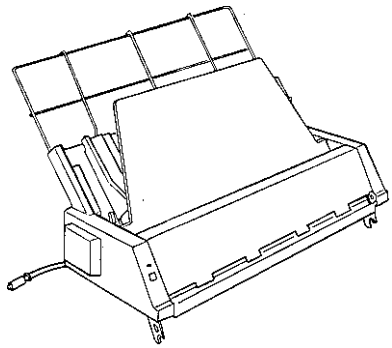


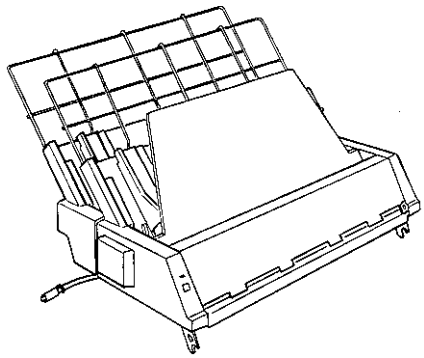
Figure 1-1 Configuration

1.2 Optional Configuration

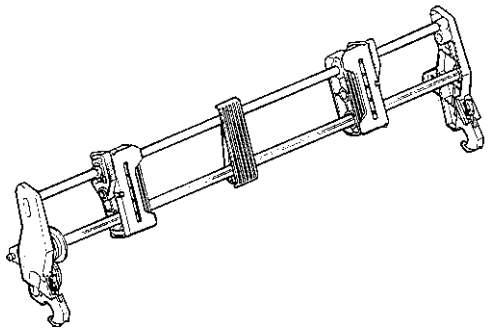
(1) **Single bin cut sheet feeder unit** (CSF)



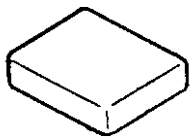
(2) **Dual bin cut sheet feeder unit** (D Bin CSF)



(3) **Pull-tractor unit**



(4) **Font cartridge**



(5) **Color printer model (Factory option)**

1.3 Installation procedure

1.3.1 Unpackaging

(1) Unpacking the packing box

1) **Open the packing box.**

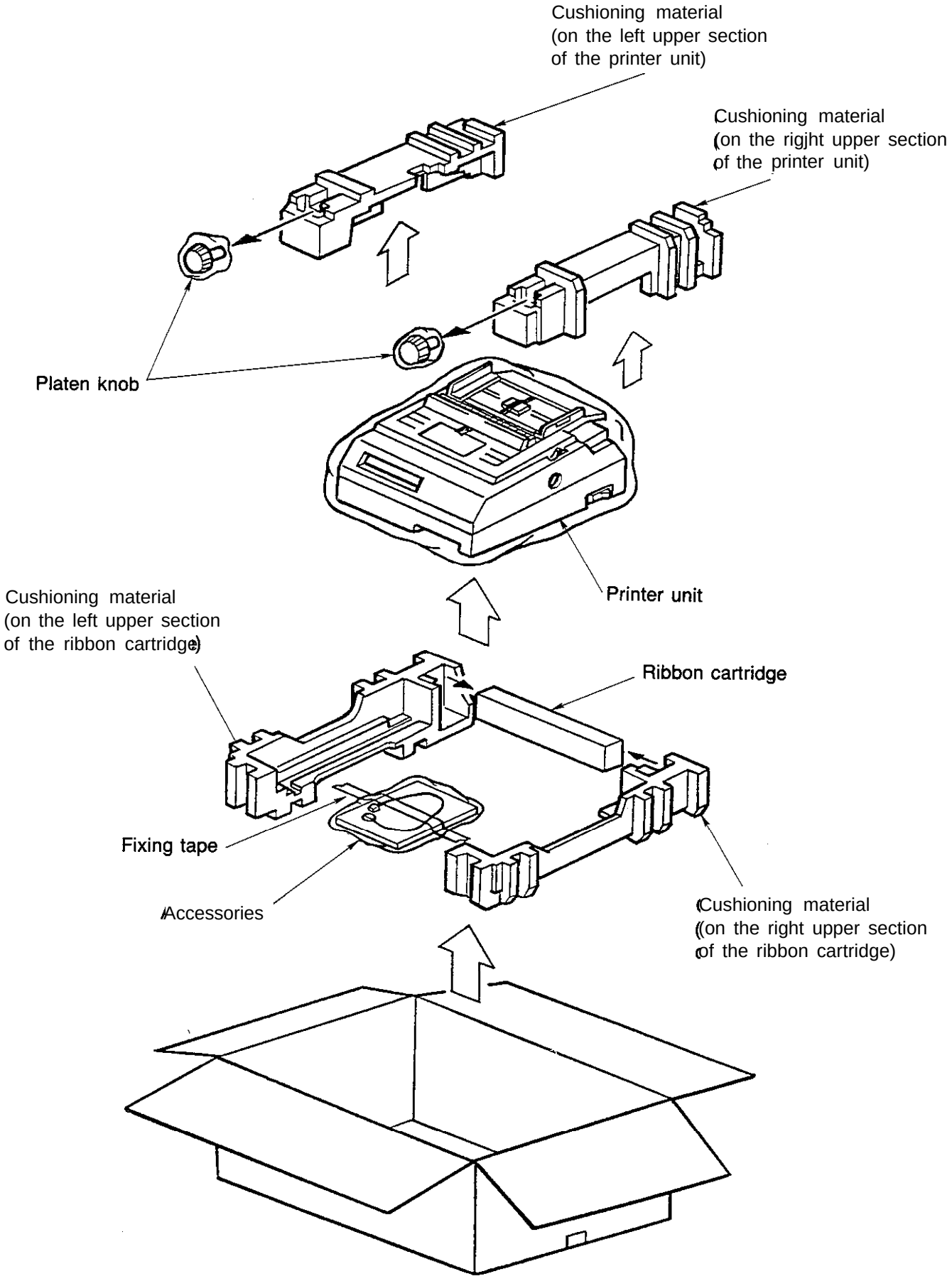
2) **Remove the two cushioning materials from the left upper and right upper sections of the printer unit.**

3) **Remove the platen knob from the cushioning materials.**

4) **Remove the printer unit.**

5) **Remove the ribbon cartridge and the cushioning materials from its right upper and left upper sections.**

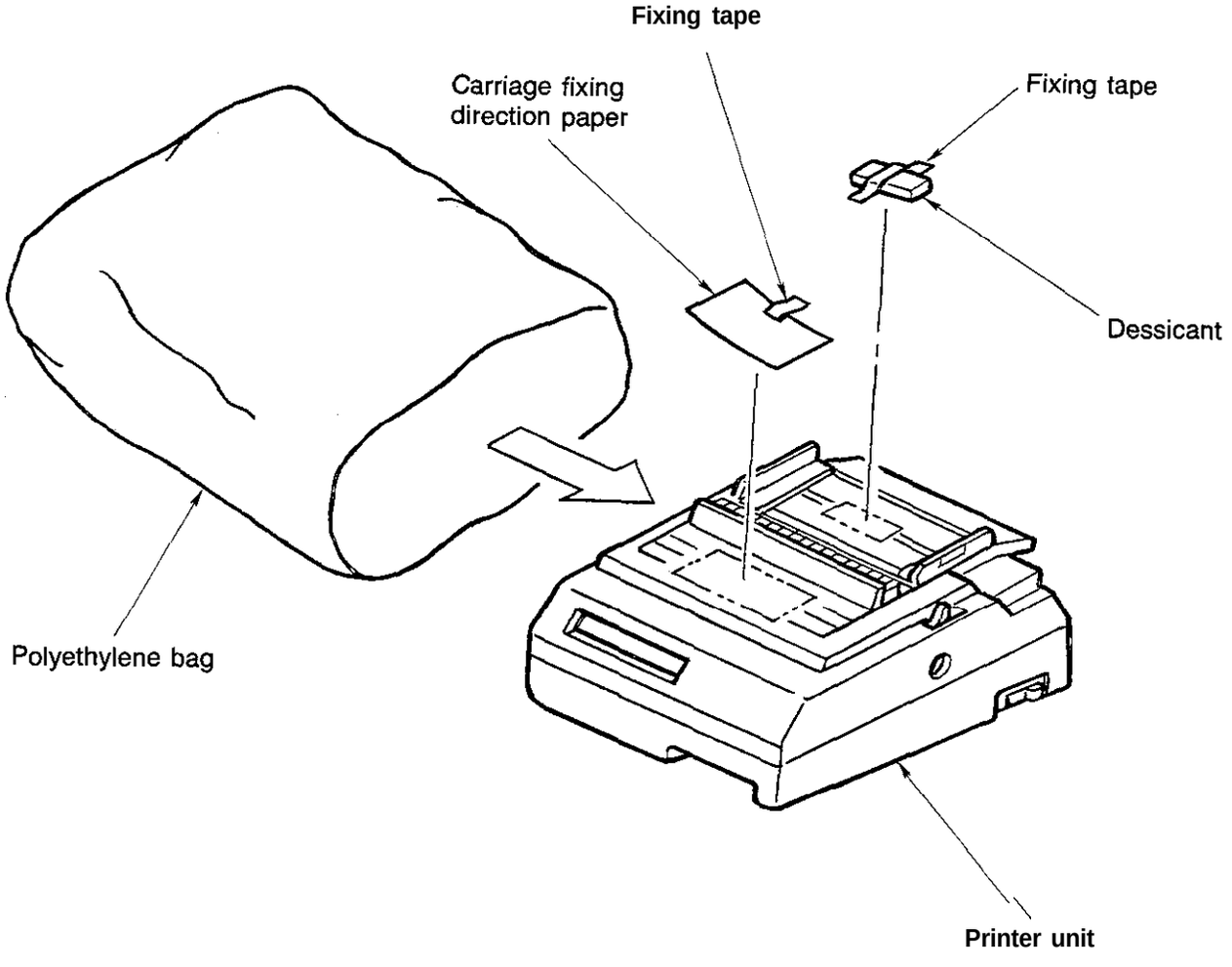
6) **Peel the fixing tape off the bottom of the packing box and remove the accessories.**


Cushioning material
(on the left upper section
of the printer unit)
Cushioning material
(on the rigjht upper section
of the printer unit)
Platen knob
Printer unit
Cushioning material
(on the left upper section
of the ribbon cartridge)
Ribbon cartridge
Fixing tape
Accessories
Cushioning material
(on the right upper section
of the ribbon cartridge)

(2) **Unpacking the package for the printer unit**

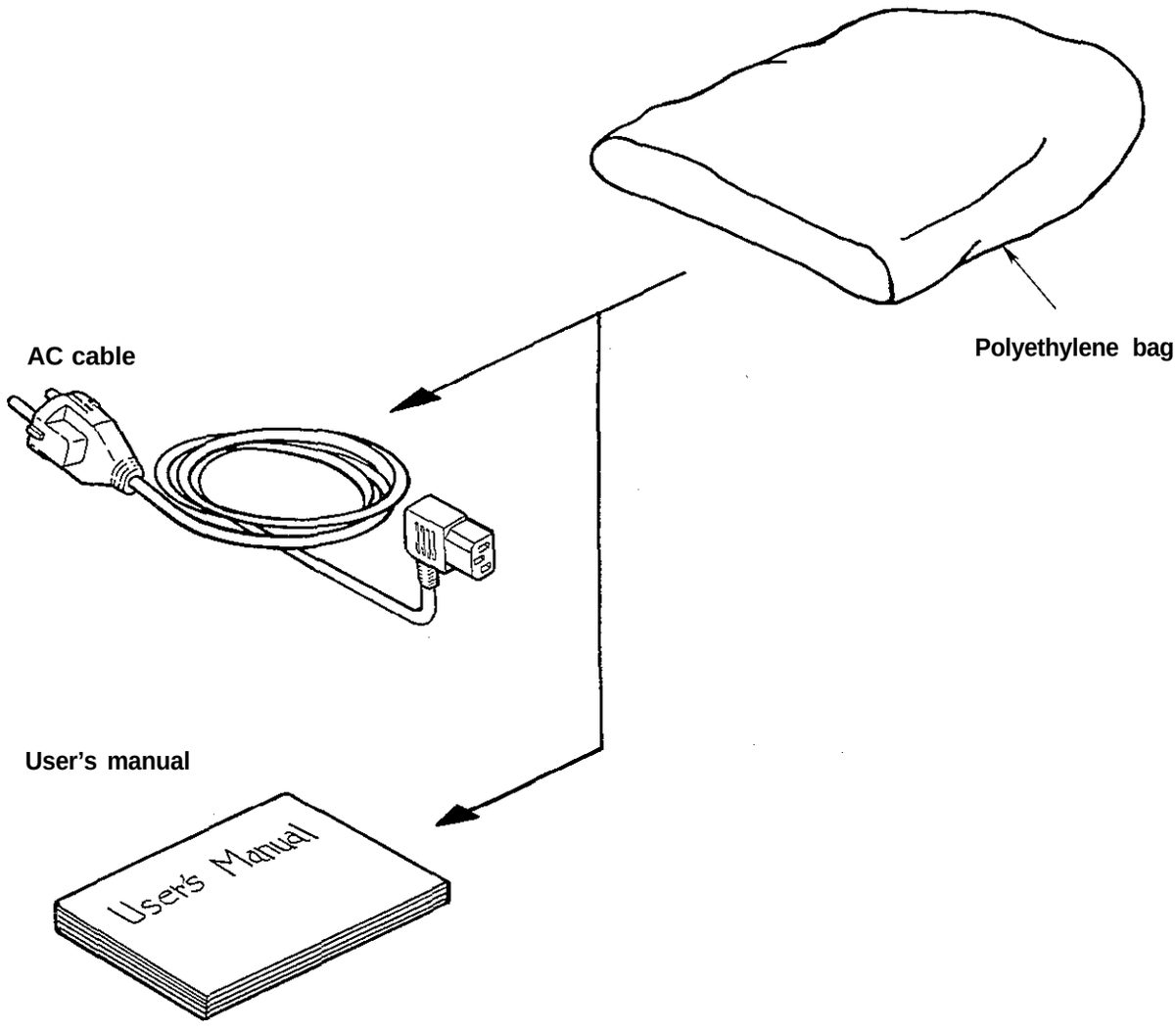
1) **Remove the printer unit from the polyethylene bag.**

2) **Peel the fixing tape off the desiccant and the carriage fixing direction paper to remove them from the printer unit.**



(3) Unpacking the package for the accessories

1) **Remove the personality cartridge, AC cable, and user's manual from the polyethylene bag.**



1.3.2 Installation (For details, refer to the Setup Guide.)

(1) Precautions for installation

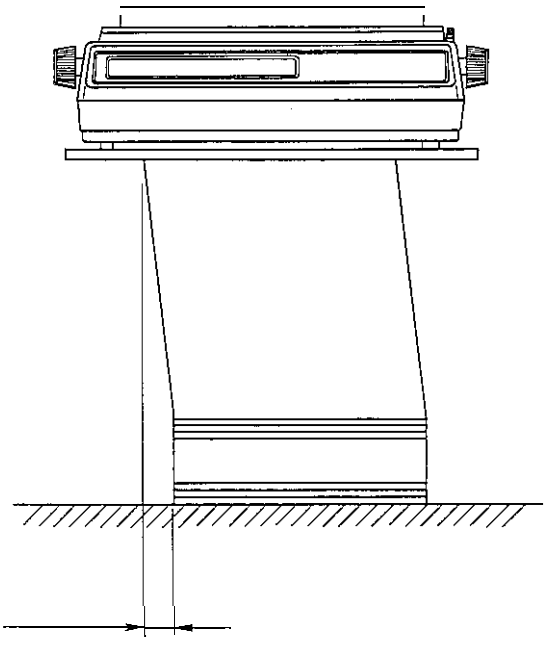
When installing the printer, observe the following precautions:

1) Do not install the printer in the following places:
- **a) Place exposed to direct sunlight**
- **b) Place with great fluctuations in temperature**
- **c) Place exposed to outdoor wind**
- **d) Dusty place**
- **e) Near a door**
- **f) Too near place to an air conditioner.**
- **g) Place subject to heavy vibrations**

2) Adjust the temperature and humidity of the installation site as follows:
Temperature: 50°F to 104°F (5°C to 40°C)
Humidity: 20%RH to 80%RH

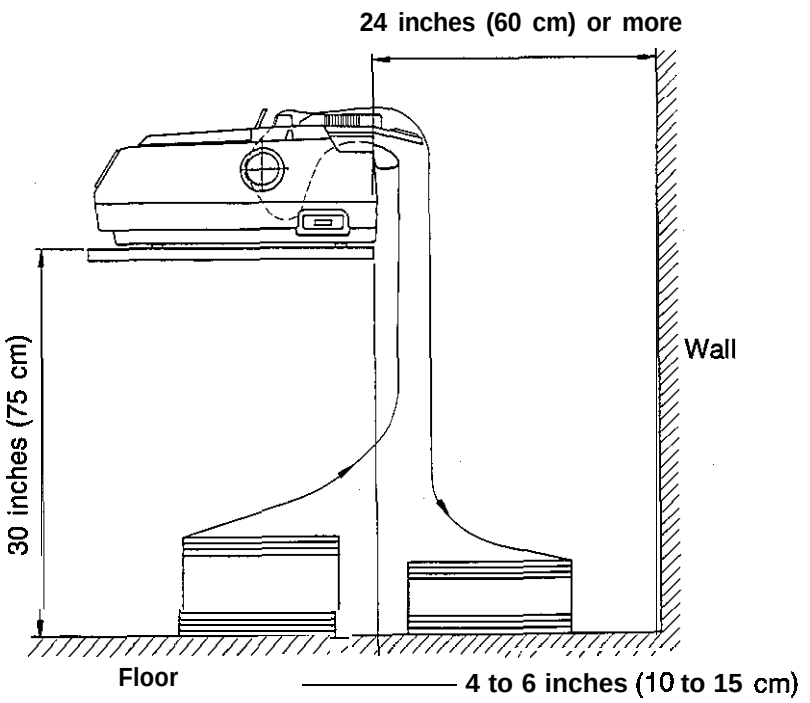
3) To set the printer and printing paper, observe the following procedure:
- **a) Adjust the height of the desk on which to place the printer to 30 inches (75 cm) as a standard. (See to it that the desk surface is horizontal and smooth and that the rubber protectors on the bottom of the desk legs are on the same plane.)**

- **b) Set the printing paper on the floor below the printer so that it may be fed into the printer without deflecting from the feeding path by more than 2 inches (5 cm).**



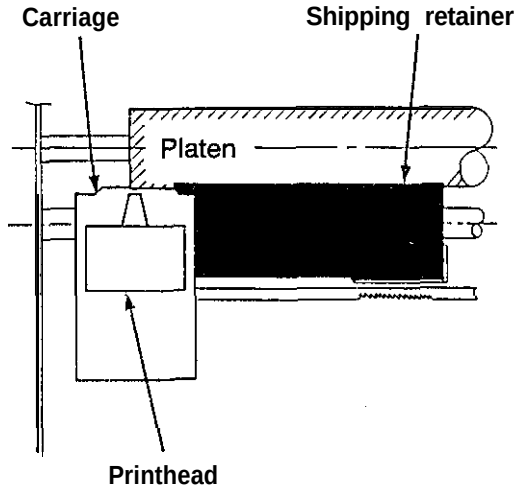
c) **Align the rear section of the printer with the rear edge of the desk. Keep a distance of 24 inches (60 cm) or more between the rear section of the printer unit and the wall to provide a space for printed paper being fed out.**

d) **Keep a distance of 4 to 6 inches (IO to 15 cm) or more between the unprinted paper fed into the printer and the printed paper fed out of the printer. If the paper going in one direction interferes with the paper going the other way, they may jam inside the printer.**



(2) Removing shipping retainer

Remove the shipping retainer that fixes the printhead.

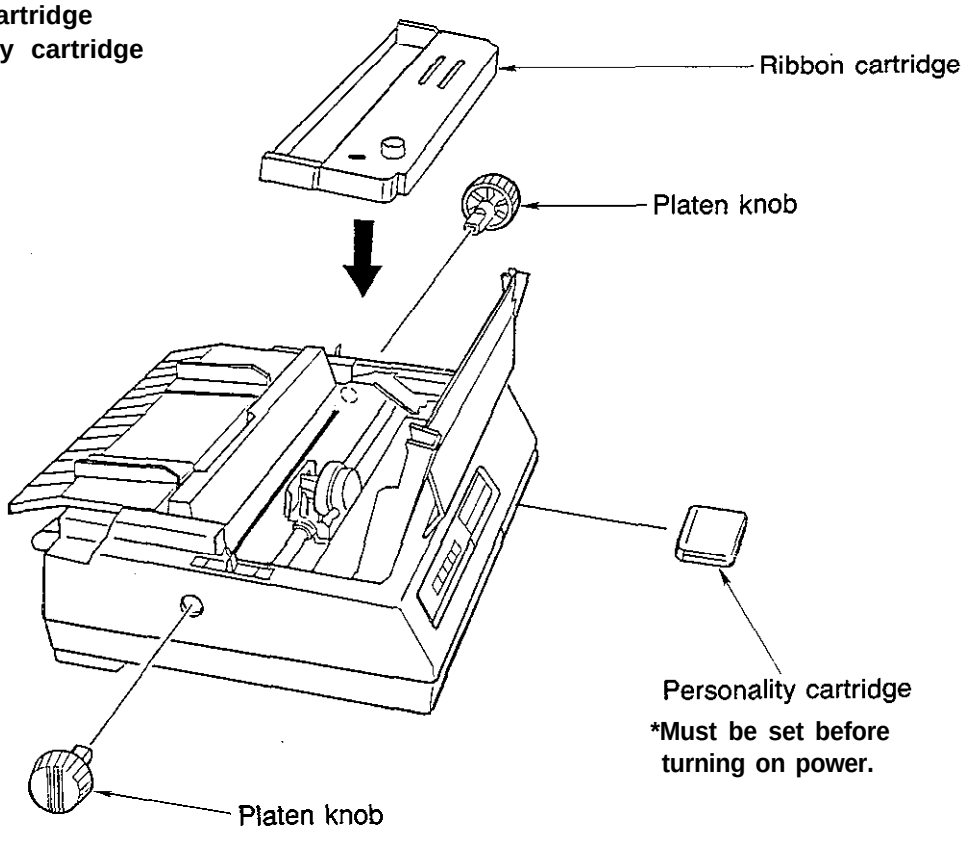


Note: Be sore to replace the shipping retainer whenever you ship your printer. It secures the print head to protect it.

(3) Fixing accessories

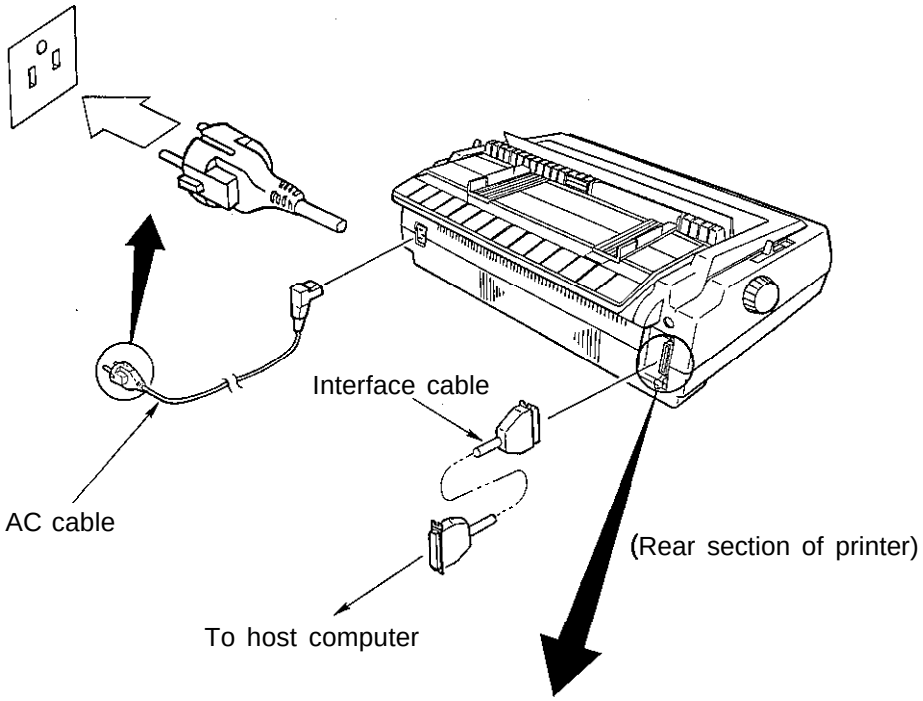
Fix the following accessories removed from the unpacked packing box on the printer unit:

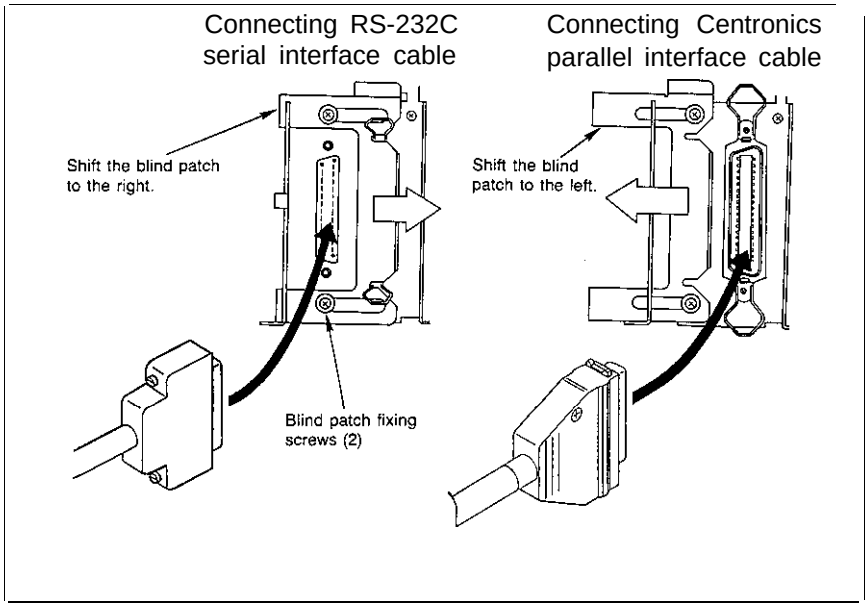
1) Two platen knobs
2) Ribbon cartridge
3) Personality cartridge



(4) Connecting cables

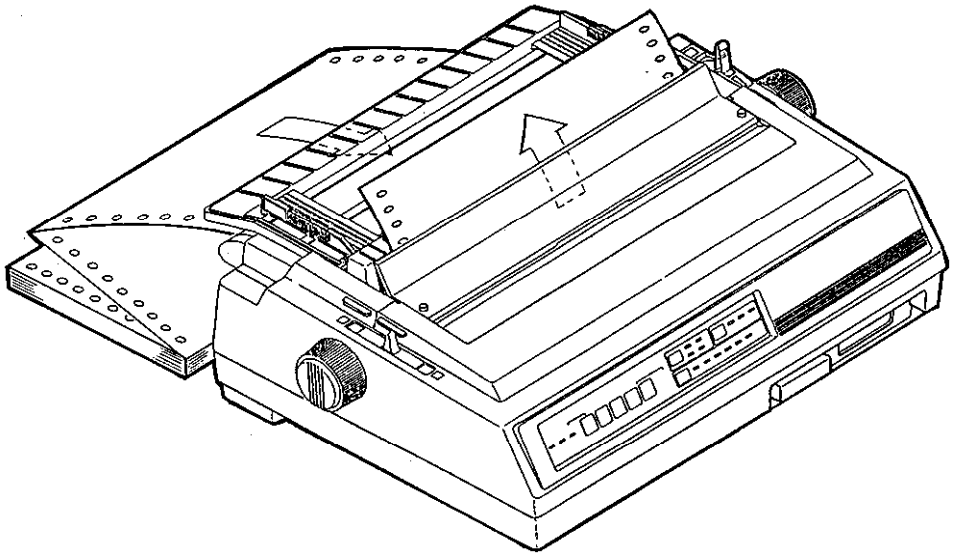
1) Connect the AC cable to the printer.
2) Connect the interface cable to the printer.




Connecting RS-232C serial interface cable
Connecting Centronics parallel interface cable
Shift the blind patch to the right.
Shift the blind patch to the left.
Blind patch fixing screws (2)

(5) Setting printing paper

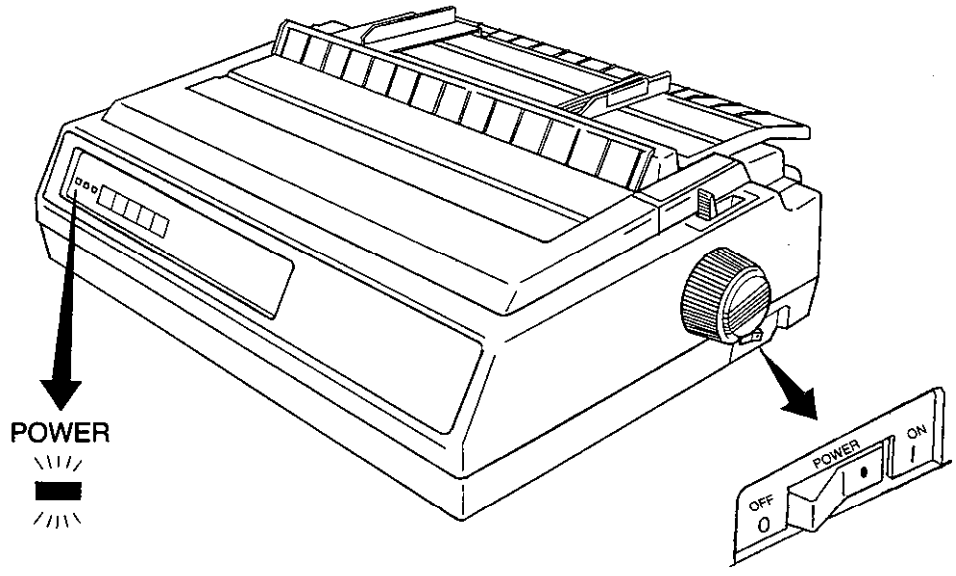
Set printing paper on the printer for the test run.



(6) Powering on

1) Turn on the POWER switch on the right side of the printer unit.

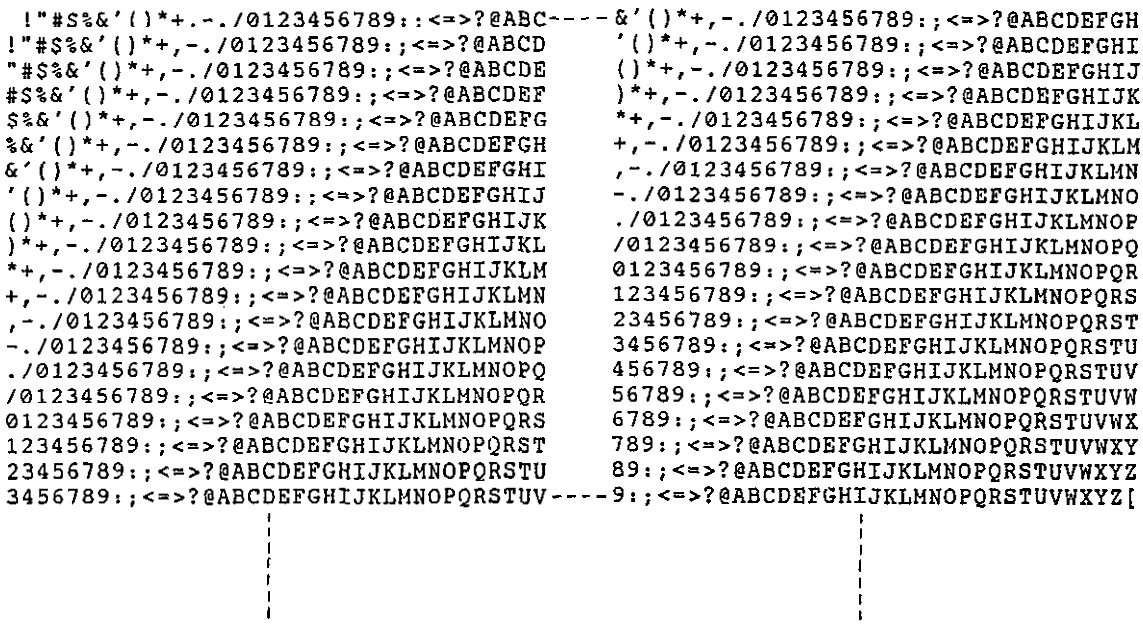
2) Confirm that the POWER LED is on and that the printhead returns to its home position.



3) If the printer unit shows no abnormality after it is powered on, proceed to the next step (7) for test printing.

(7) Test printing

1) After confirming that the POWER switch is off,turn it on while pressing the QUIET switch.
2) Confirm that the printer unit prints out the test pattern as shown in the figure below.
3) Press the SELECT switch to end the printing test.
4) Confirm that the SELECT lamp is on, indicating that the printer unit is ready to receive printing data from the host computer.

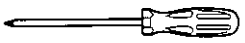
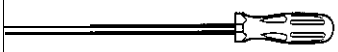
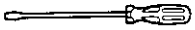
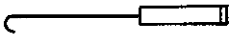
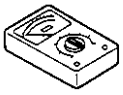
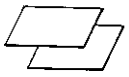
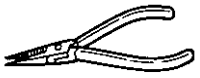
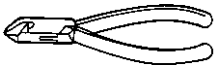
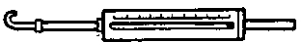


2. SERVICE TOOLS

2. SERVICE TOOLS

Table 2.1 lists the tools necessary for replacing printed circuit boards and parts of units in the field.

Table 2.1 Service tools

NO.	Service tool		Q'ty	Use	Remarks
1		No. I-100 Phillips screwdriver	1	Screws 2.6 mm	
		No. Z-200 Phillips screwdriver	1	Screws 3 - 5 mm	
3		No. 3-100 screwdriver	1		
4		Spring hook	1		
5		7 mm wrench	1		
6		Volt/ohmmeter	1		
7		Feeler gauge	1	Head gap adjustment	
8		Film gauge		Ribbon protector gap adjustment	Necessary size: 0.008 ″ (0.2 mm) and 0.006” (0.15 mm)
9		Pliers	1		
10		No. 5 nippers	1		
11		1.1 lbs (500 g) bar pressure gauge	1		
12		Ribbon protector gauge		Ribbon protector gap adjustment	Use for Jig A (4PP4043-3815G1)

3. CLEANING

3. CLEANING

[Cautions]

1. **Be sure to turn OFF the AC POWER switch before cleaning.**
2. **Do not allow dust to get inside the mechanism unit when cleaning.**
3. **If a lubricated part has been cleaned, be sure to apply lubricating oil to that portion after cleaning.**

(1) Cleaning time

When the equipment operating time has reached six months or 300 hours, whichever comes first.

(2) Cleaning tools

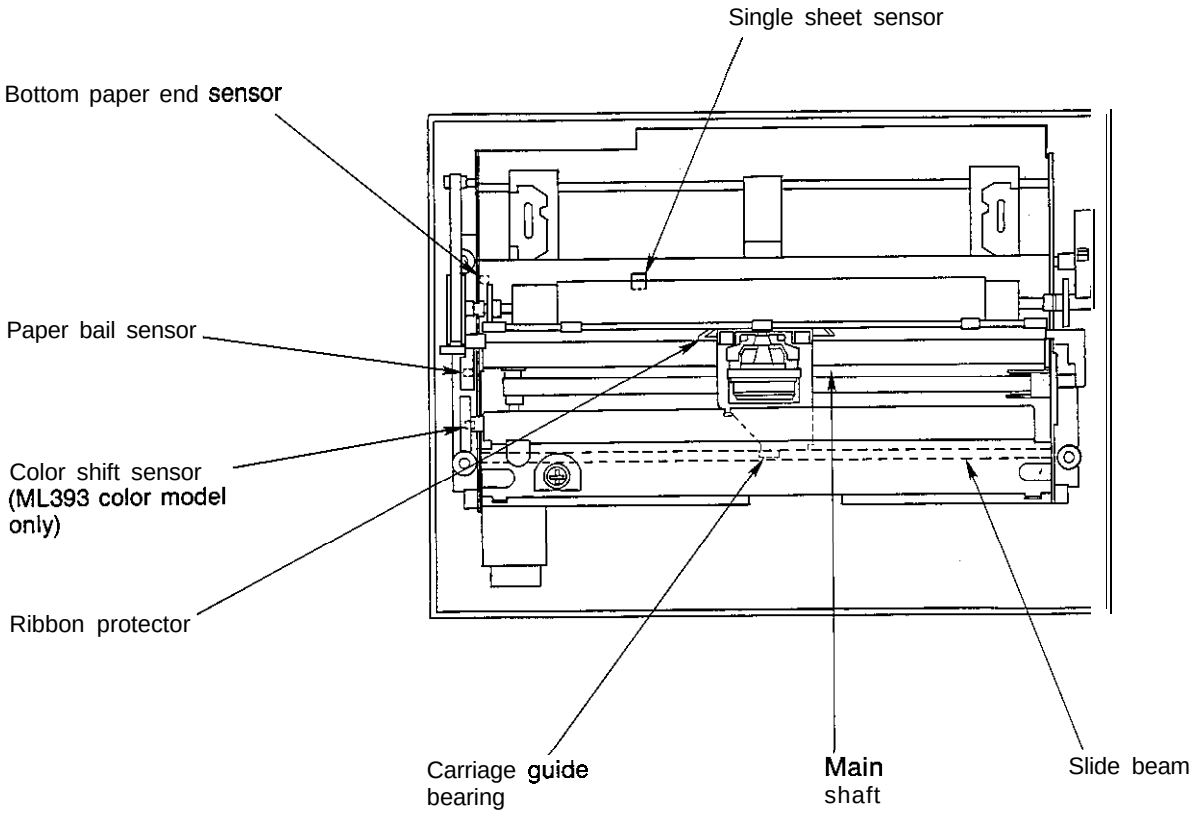
Dry cloth (soft cloth such as gauze), brush, cotton swab, vacuum cleaner

(3) Places to be cleaned

Table 3.1 lists the places to be cleaned:

Table 3.1

Place to be cleaned	Cleaning procedure
Main shaft and surrounding portion Top surface of slide beam Form runner portion Ribbon protector and surrounding portion	Remove paper dust, and wipe off dirt, dust, and ribbon dust.
Single sheet sensor Paper bail sensor Bottom paper end sensor Color shift sensor (Color model)	Wipe off dirt from sensor. Wipe off dirt in the sensor window with a brush.
Carriage guide bearing	Wipe off dirt and dust


Single sheet sensor
Bottom paper end sensor
Paper bail sensor
Color shift sensor
(ML393 color model
only)
Ribbon protector
Carriage guide
bearing
Main
shaft
Slide beam

4. LUBRICATION

4. LUBRICATION

(1) Cleaning time

When the operating hours have reached one year or 600 hours.

(2) lubricant

- Pan motor oil 10W-30 (or equivalent): PM
- Alvania grease #2EP (or equivalent) : GEP

(3) Amount of lubricant

- Large amount Ⓐ: Apply abundantly.
- Medium amount Ⓑ: Apply three to four drops of oil, or 0.008 inch (0.2 mm) thick grease.
- Small amount Ⓒ: Apply one drop of oil.

(4) lubrication inhibit points

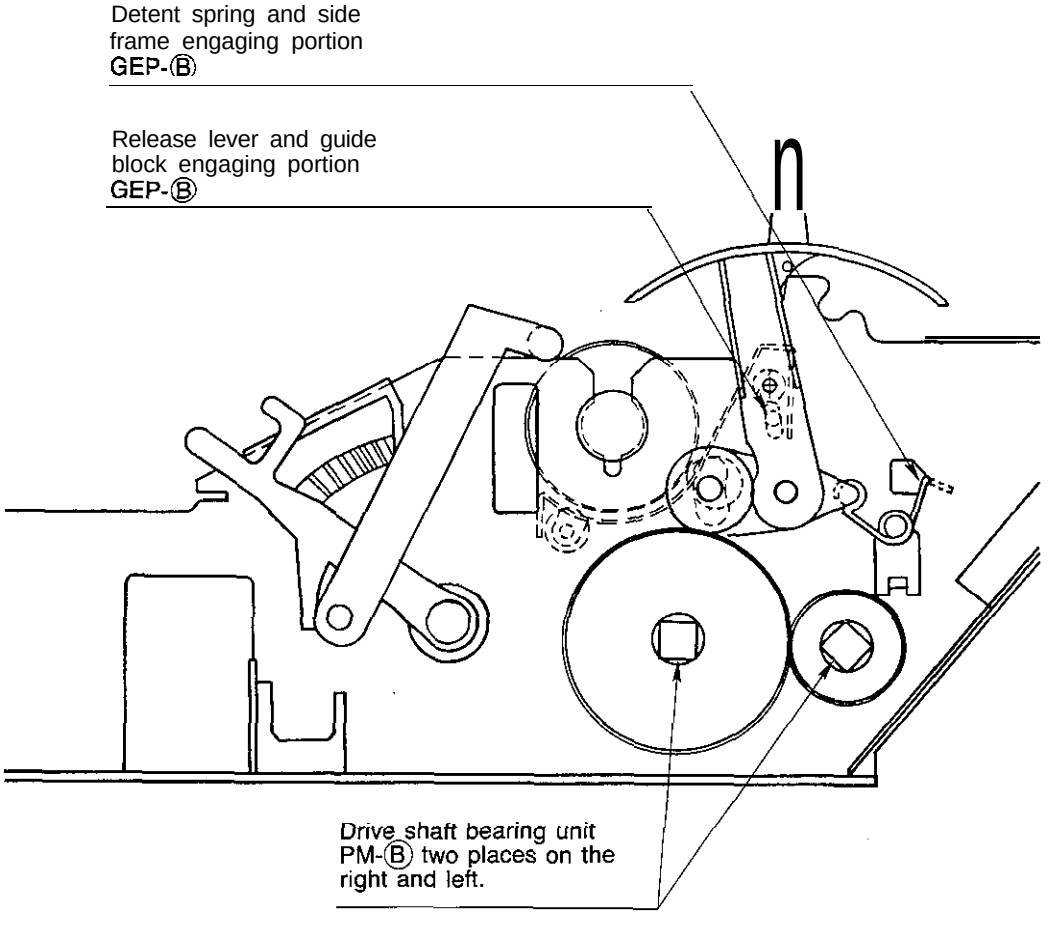
(a) Monochrome model

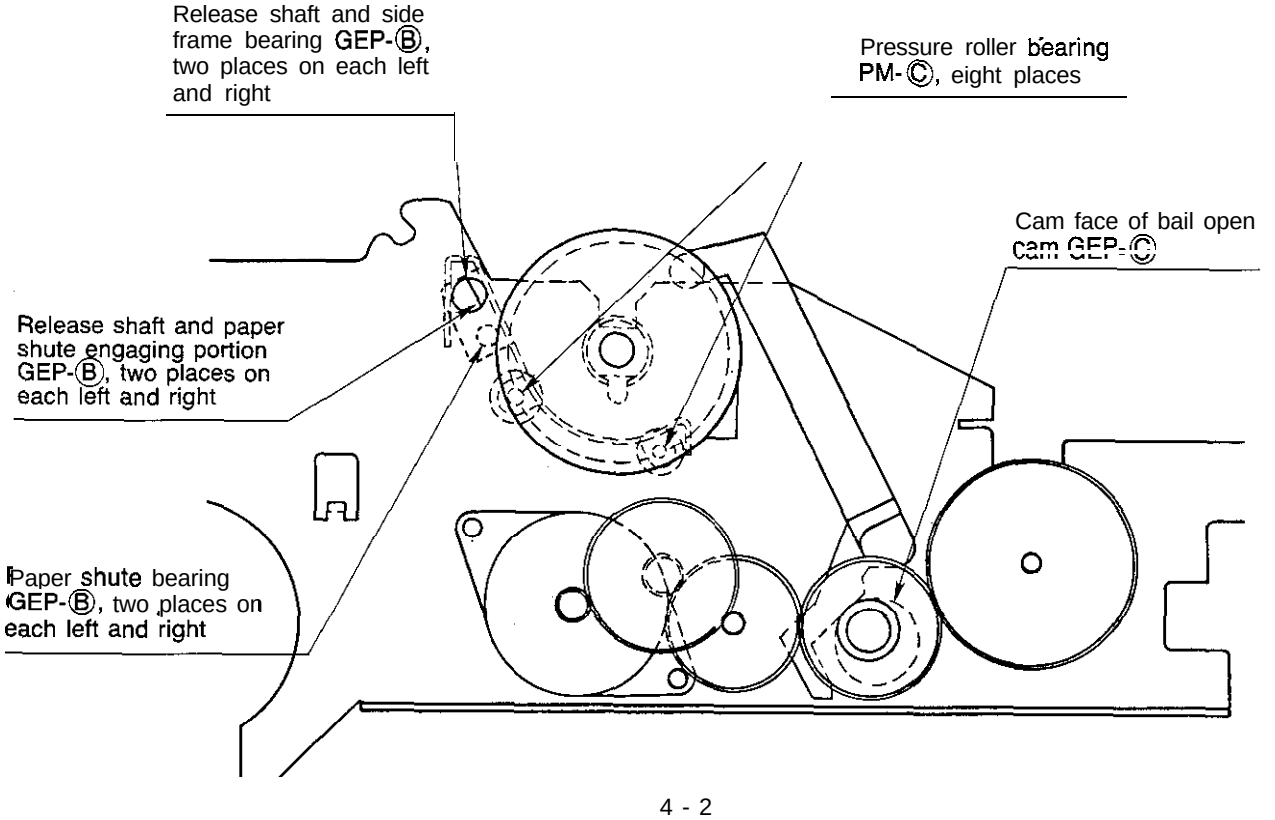
NO.	Inhibit point	Reason	Remarks
1	Ink ribbon	To prevent blurring of print image	
2	Sensors	To prevent dust attachment	
3	Platen assembly (rubber face	To prevent stained paper	
4	Sheet feeder assembly	To prevent stained paper	
5	Mini-pitch belt	To prevent deterioration and elongation of rubber	
6	Mini-pitch belt pulley tooth face	To prevent deterioration and elongation of rubber	
7	Head cable assembly	To prevent cable break	
8	Print head	To prevent malfunction of print head	

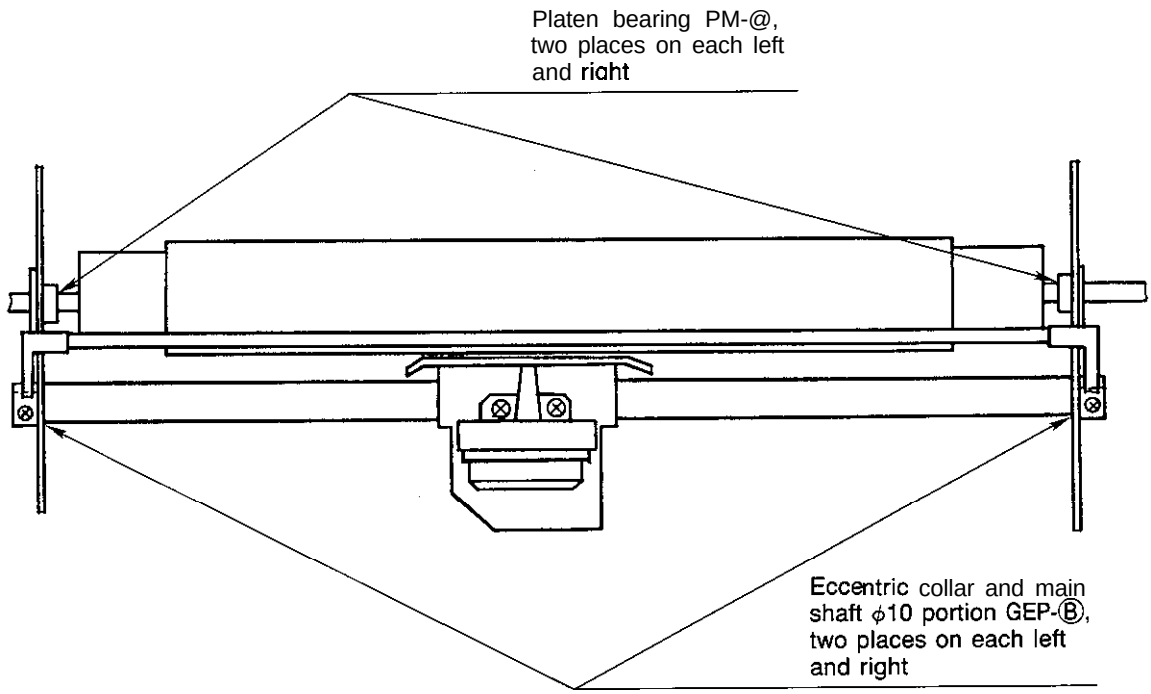
(b) Color model

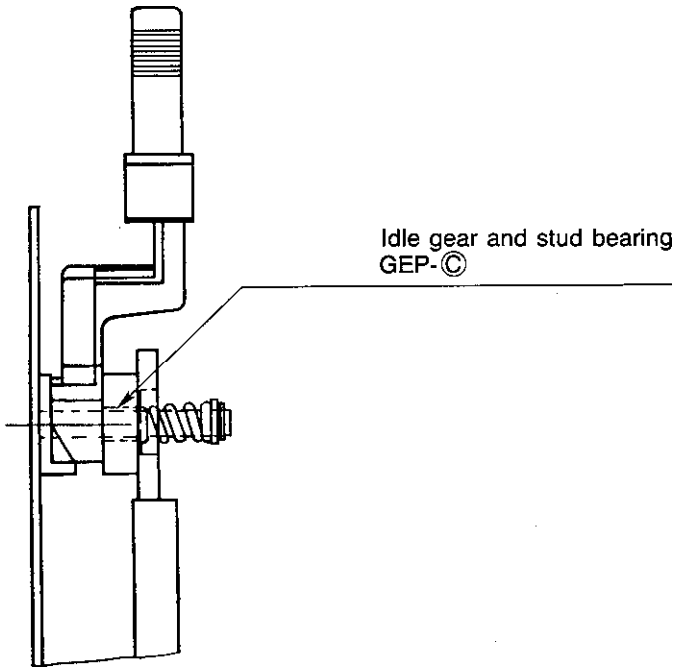
No.	Inhibit point	Reason	Remarks
1	Around ribbon shift cam	To prevent deterioration of brake force	

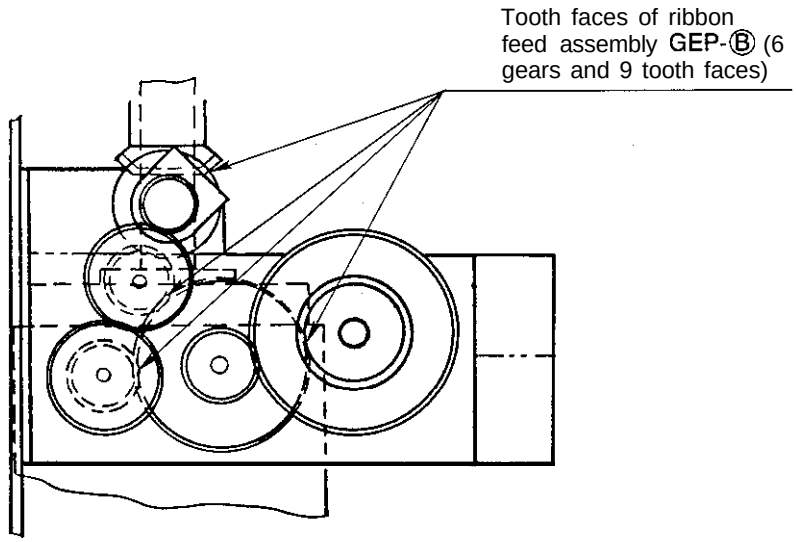
(5) Lubrication points

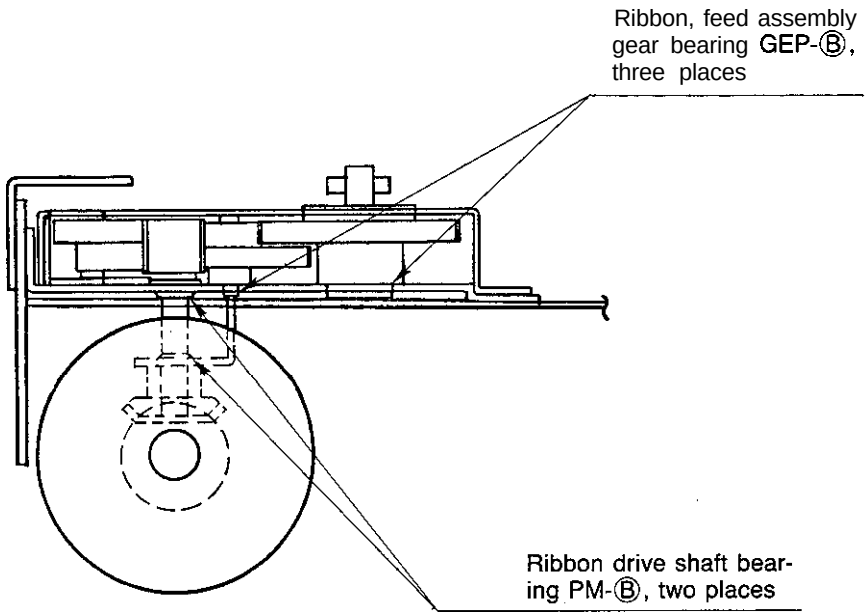

Detent spring and side frame engaging portion GEP-Ⓑ
Release lever and guide block engaging portion GEP-Ⓑ
Drive shaft bearing unit PM-Ⓑ two places on the right and left.


Release shaft and side frame bearing GEP-Ⓑ, two places on each left and right
Pressure roller bearing PM-Ⓒ, eight places
Cam face of bail open cam GEP-Ⓒ
Release shaft and paper shute engaging portion GEP-Ⓑ, two places on each left and right
Paper shute bearing GEP-Ⓑ, two places on each left and right

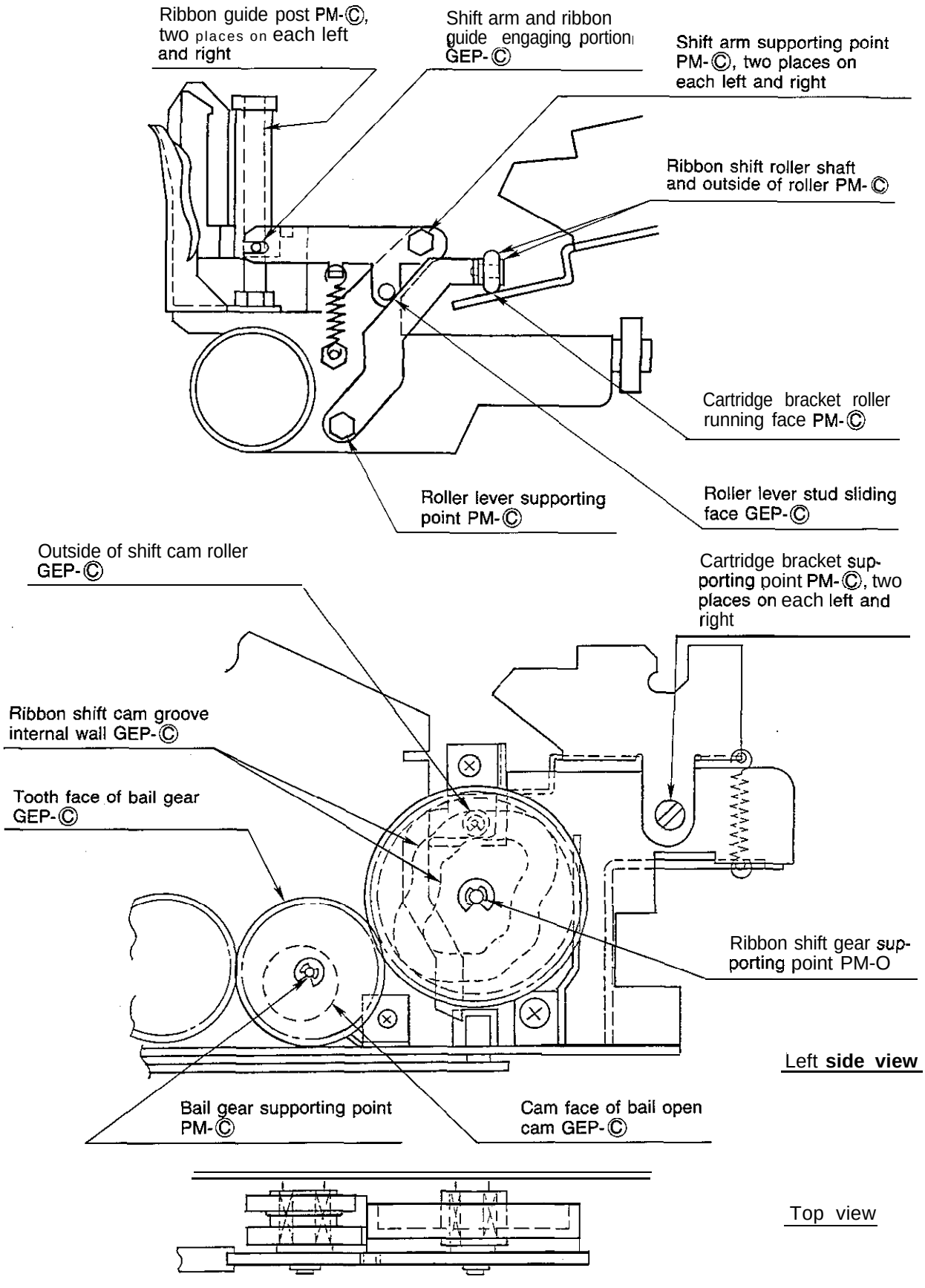

Platen bearing PM-@, two places on each left and right
Eccentric collar and main shaft ϕ10 portion GEP-Ⓑ, two places on each left and right


Idle gear and stud bearing GEP-Ⓒ

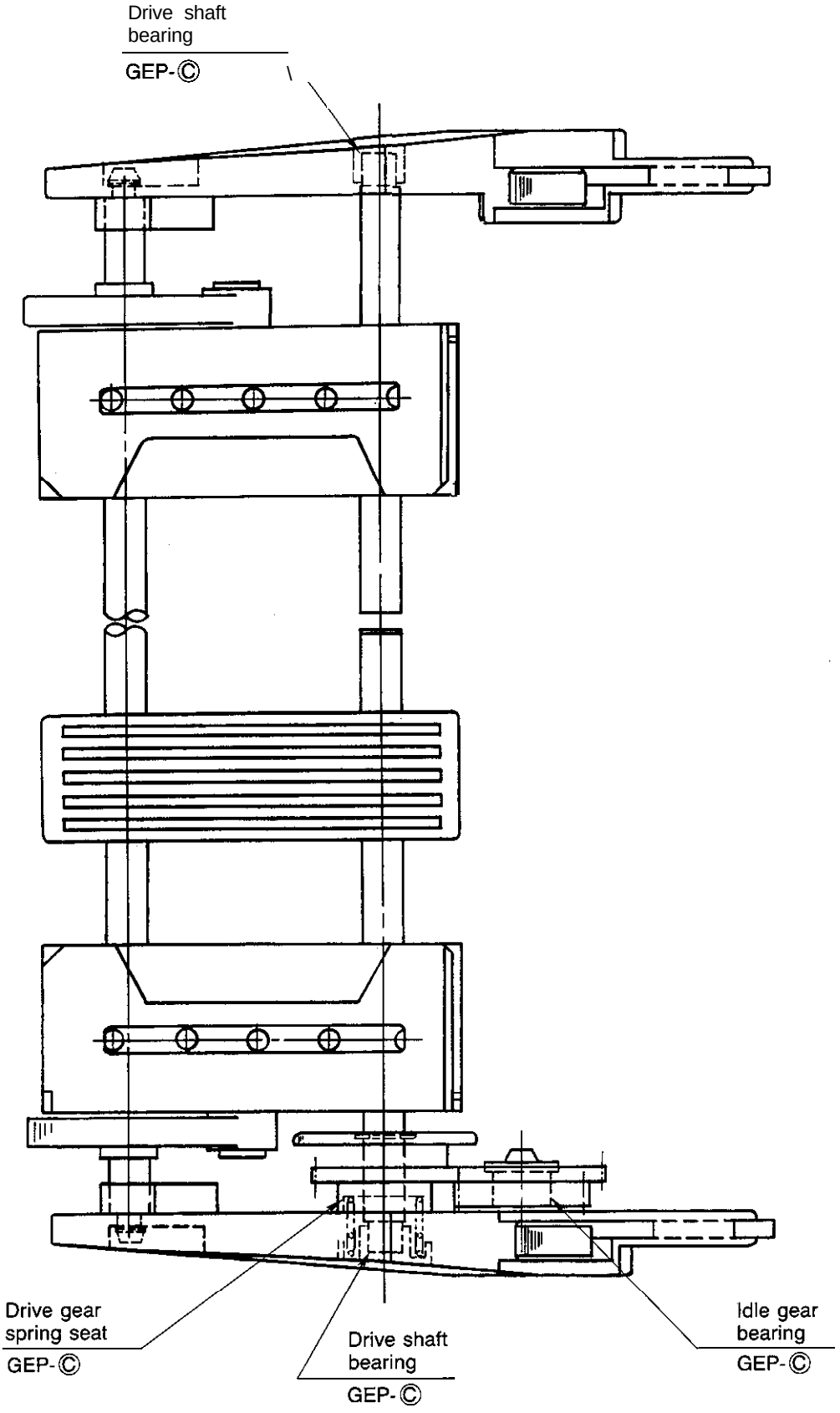

Tooth faces of ribbon feed assembly GEP-Ⓑ (6 gears and 9 tooth faces)


Ribbon, feed assembly gear bearing GEP-Ⓑ, three places
Ribbon drive shaft bearing PM-Ⓑ, two places

(6) Lubrication points of color model


Ribbon guide post PM-Ⓒ, two places on each left and right
Shift arm and ribbon guide engaging portion GEP-Ⓒ
Shift arm supporting point PM-Ⓒ, two places on each left and right
Ribbon shift roller shaft and outside of roller PM-Ⓒ
Cartridge bracket roller running face PM-Ⓒ
Roller lever supporting point PM-Ⓒ
Roller lever stud sliding face GEP-Ⓒ
Outside of shift cam roller GEP-Ⓒ
Cartridge bracket supporting point PM-Ⓒ, two places on each left and right
Ribbon shift cam groove internal wall GEP-Ⓒ
Tooth face of bail gear GEP-Ⓒ
Ribbon shift gear supporting point PM-O
Left side view
Bail gear supporting point PM-Ⓒ
Cam face of bail open cam GEP-Ⓒ
Top view

(7) Lubrication points of pull tractor unit (option)



5. ASSEMBLY/DISASSEMBLY SECTION

5. ASSEMBLY/DISASSEMBLY SECTION

This section explains the procedures for removing and installing various assemblies and units in the field.

Description is mainly limited to the removal procedure; installation should basically be performed in the reverse sequence of the removal procedure.

5.1 Cautions on Assembly/Disassembly

(1) **Before starting disassembly, be sure to turn OFF the AC POWER switch, and disconnect the AC cord.**

(2) **Do not disassemble the printer as long as it is operating normally.**

(3) **Do not remove unnecessary parts, and limit the disassembly area as small as possible.**

(4) **Use the designated service tools.**

(5) **Carry out disassembly in the prescribed sequence; otherwise, damage to the parts may result.**

(6) **It is advisable to temporarily install screws, snap rings and other small parts in their original positions to avoid losing them.**

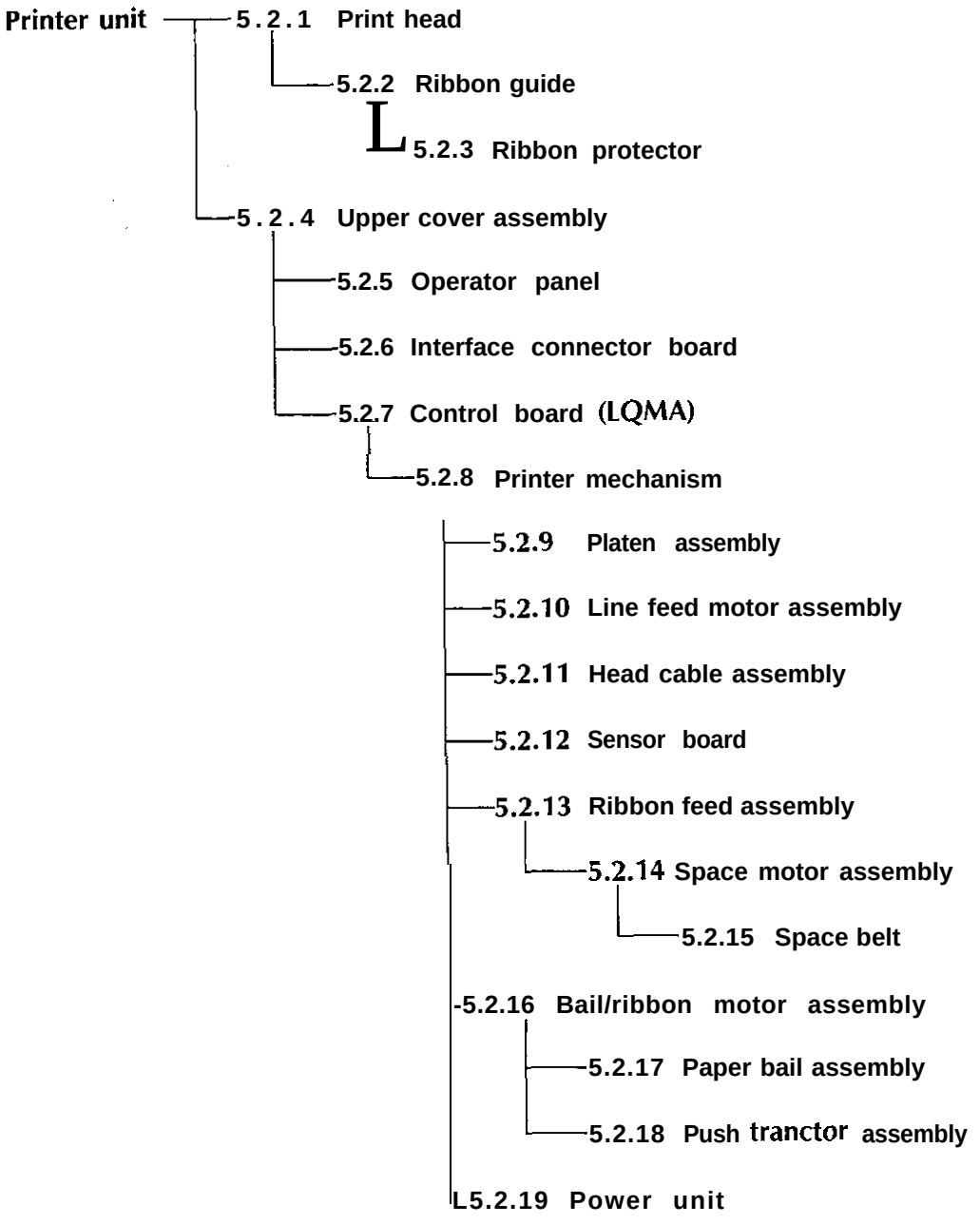
(7) **Whenever handling the microprocessors, ROM, RAM IC chips and boards, do not use gloves which may cause static electricity.**

(8) **Do not place the printed circuit board directly on the equipment or on the floor.**

(9) **If adjustment is specified in the middle of installation, follow the instructions.**

5.2 Assembly/Disassembly Procedures

This section explains the assembly replacement procedures according to the following disassembly system.



5.2.1 Printhead

[Caution]
The printhead may be hot immediately after printing.

(1) **Turn OFF the AC POWER switch, and remove AC cord ① from the receptacle.**

(2) **Open access cover ② .**

(3) **Remove ribbon cartridge ③ .**

(4) **Pull down head gap adjusting lever ④ to the front range (range 9 position).**

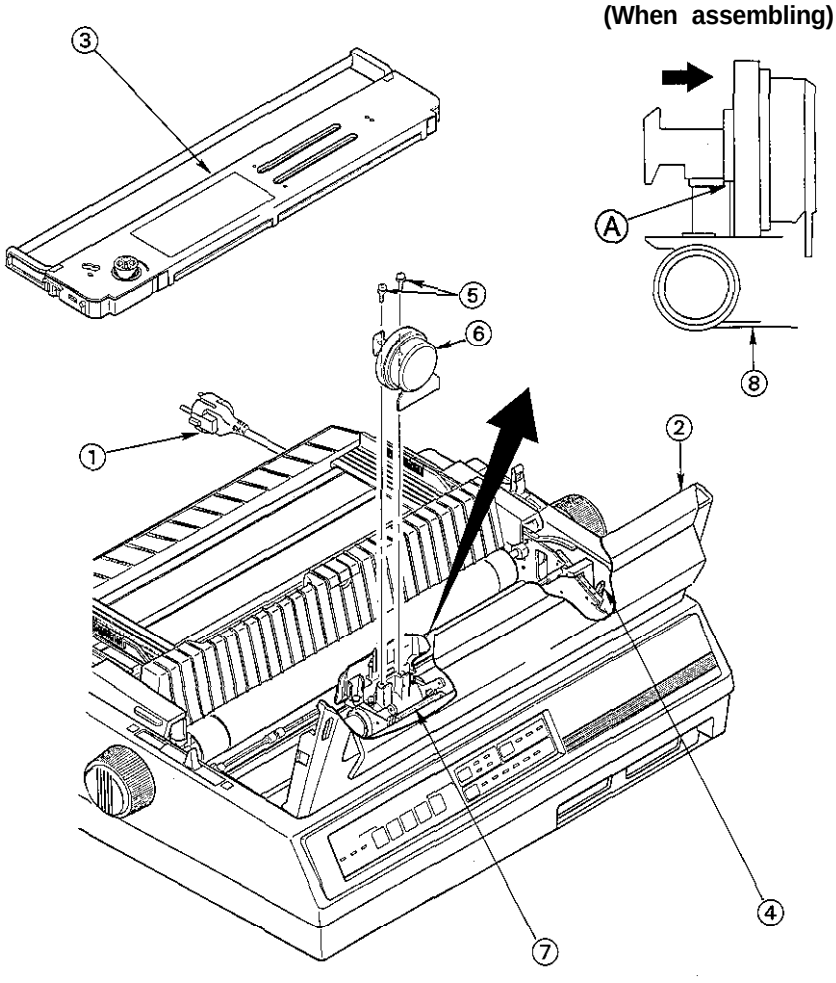
(5) **Remove two screws ⑤ , and disconnect printhead ⑥ from connector ⑦ by lifting up vertically.**

(6) **To install, reverse the removal procedures sequence.**

[Note on installation]

(1) Install print head ⑥ while pressing it in the direction of the arrow so that it will contact tight/y surface Ⓐ of carriage frame ⑧

(When assembling)

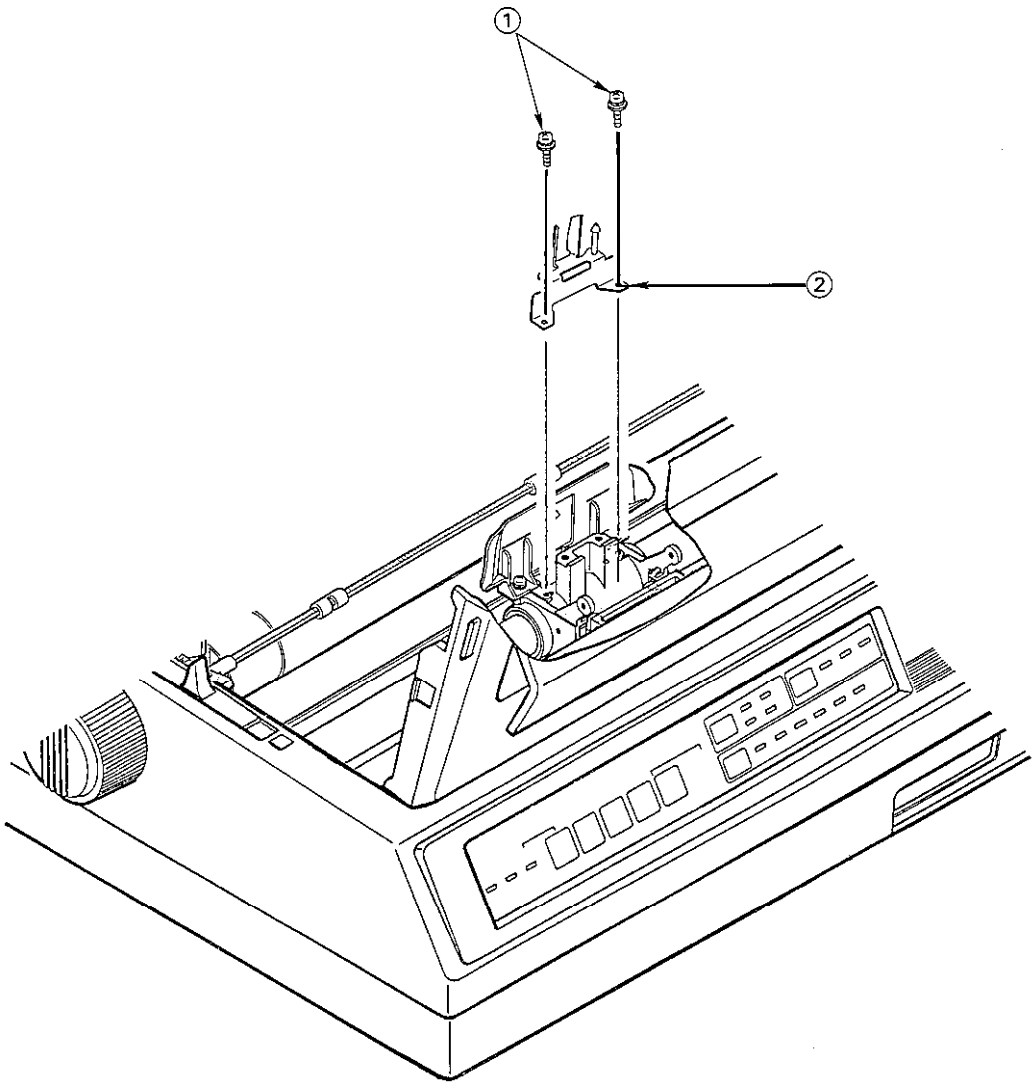


5.2.2 Ribbon Guide

(1) **Remove the printhead. (See section 5.2.1.).**

(2) **Remove two screws ① , then remove ribbon guide ②**

(3) **To install, reverse the removal procedure sequence.**



5.2.3 Ribbon Protector

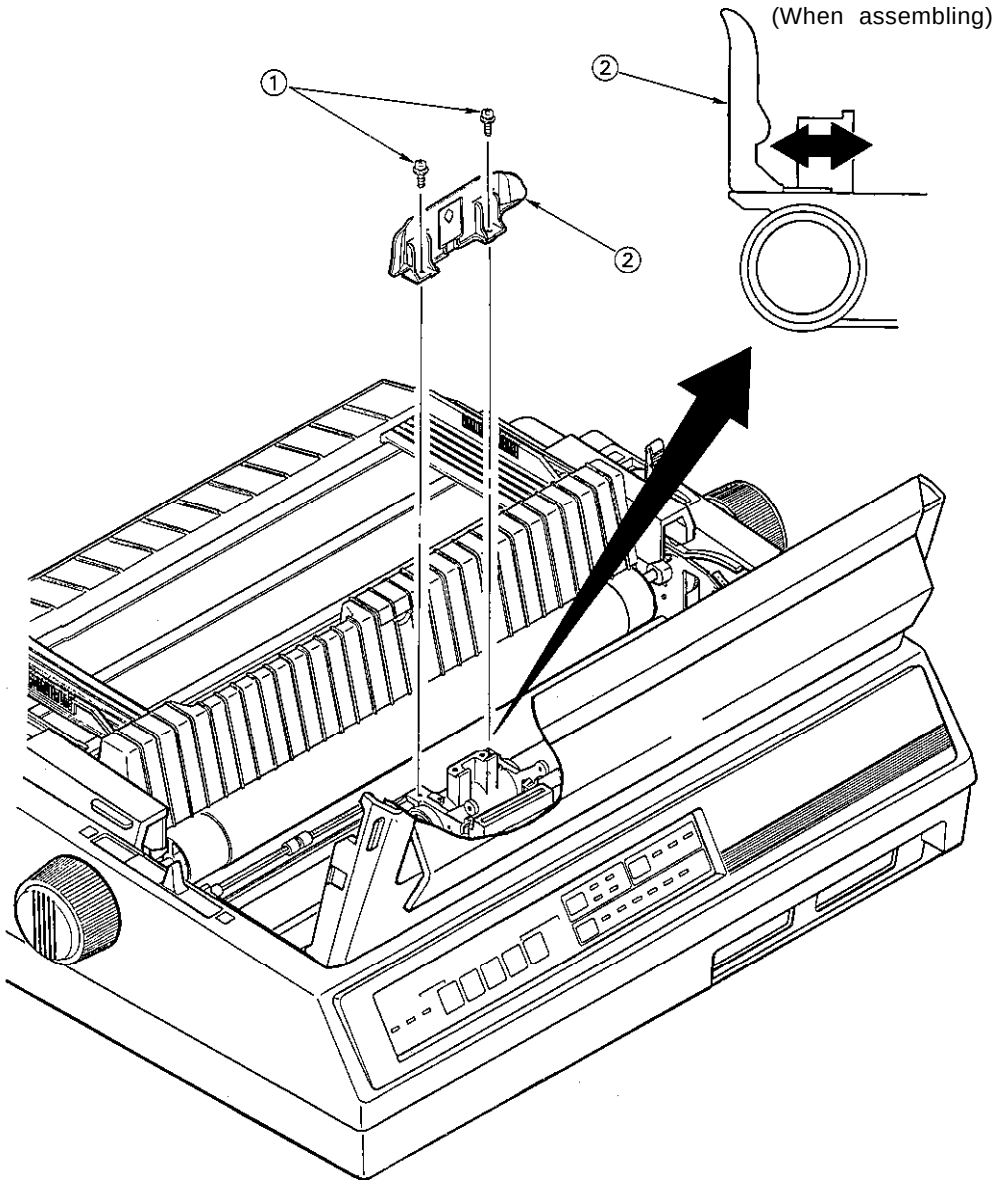
(1) **Remove the ribbon guide. (See section 5.2.2.).**

(2) **Remove two screws ① , then remove ribbon protector ② by lifting up.**

(3) **To install, reverse the removal procedure sequence.**

[Notes on installation]

(1) *Align the print head center with the center of the ribbon protector hole,*
(2) Adjust the gap between the ribbon protector and the platen. (See section 6.2.)



5.2.4 Upper Cover Assembly

(1) **Set the AC POWER switch to OFF and pull out the AC plug ① from the receptacle.**

(2) **Disconnect interface cable ② .**

(3) **Pull out two platen knob ③ .**

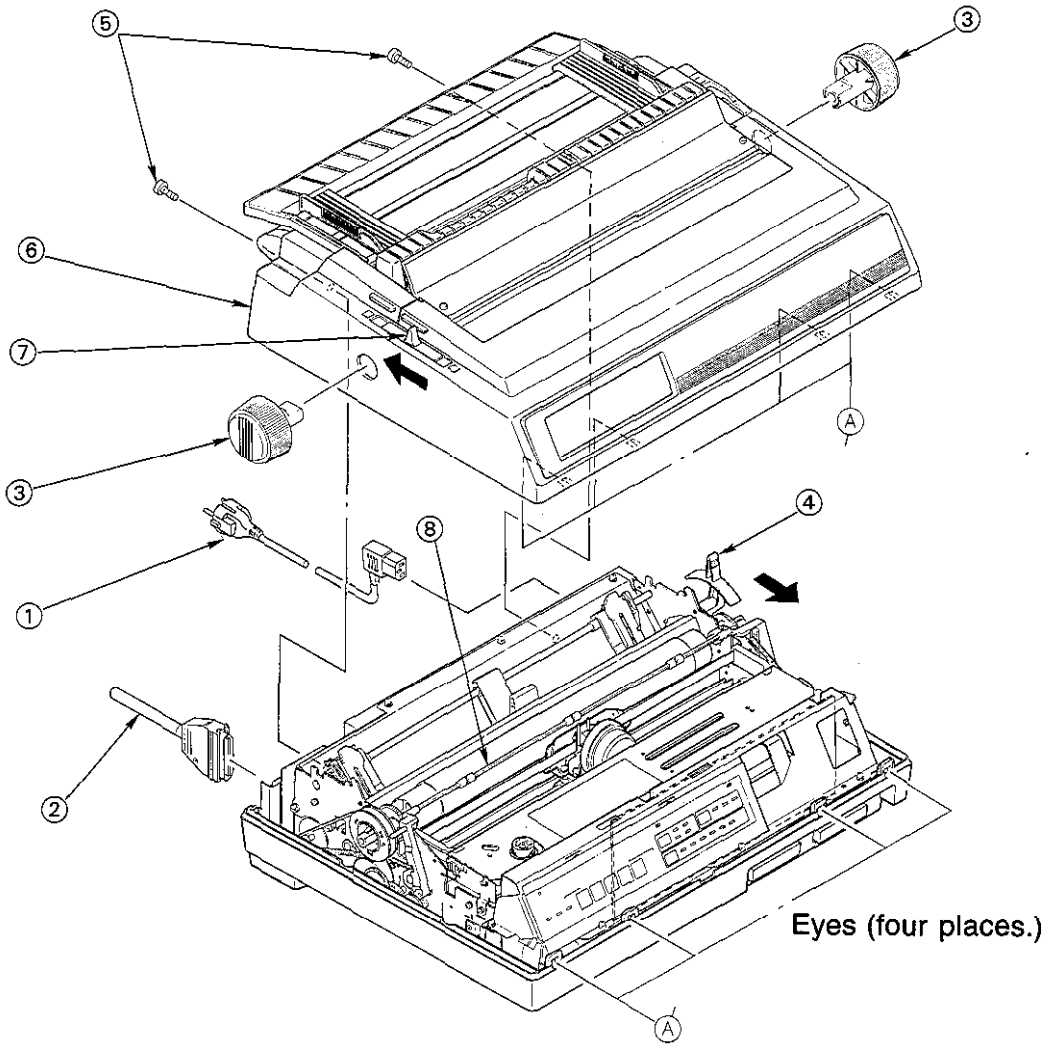
(4) **Turn release lever ④ forward.**

(5) **Remove two screws ⑤ in the rear of the printer. Lift the rear end of upper cover assembly ⑥ on the front part and slide it toward the front to take it off from the four eyes. Then remove the whole upper cover assembly by lifting it vertically.**

(6) **To install, reverse the removal procedure sequence.**

[Notes on *installation]*

(1) At installation of the upper cover assembly, turn bail open lever ⑦ backward. Confirm that the paper bail ⑧ moves according to the bail open lever after installation.



5.2.5 Operator Panel

(1) **Remove the upper cover. (See section 5.2.4.)**

(2) **Disconnect cable ① of operator panel ⑦ from connector CN10 ③ of control board ② (Pull the locking piece ⑧ by arrow a to remove.)**

(3) **Remove two screws ④**

(4) **Remove the operator panel holder@ by moving it upward, and then pulling to the front.**

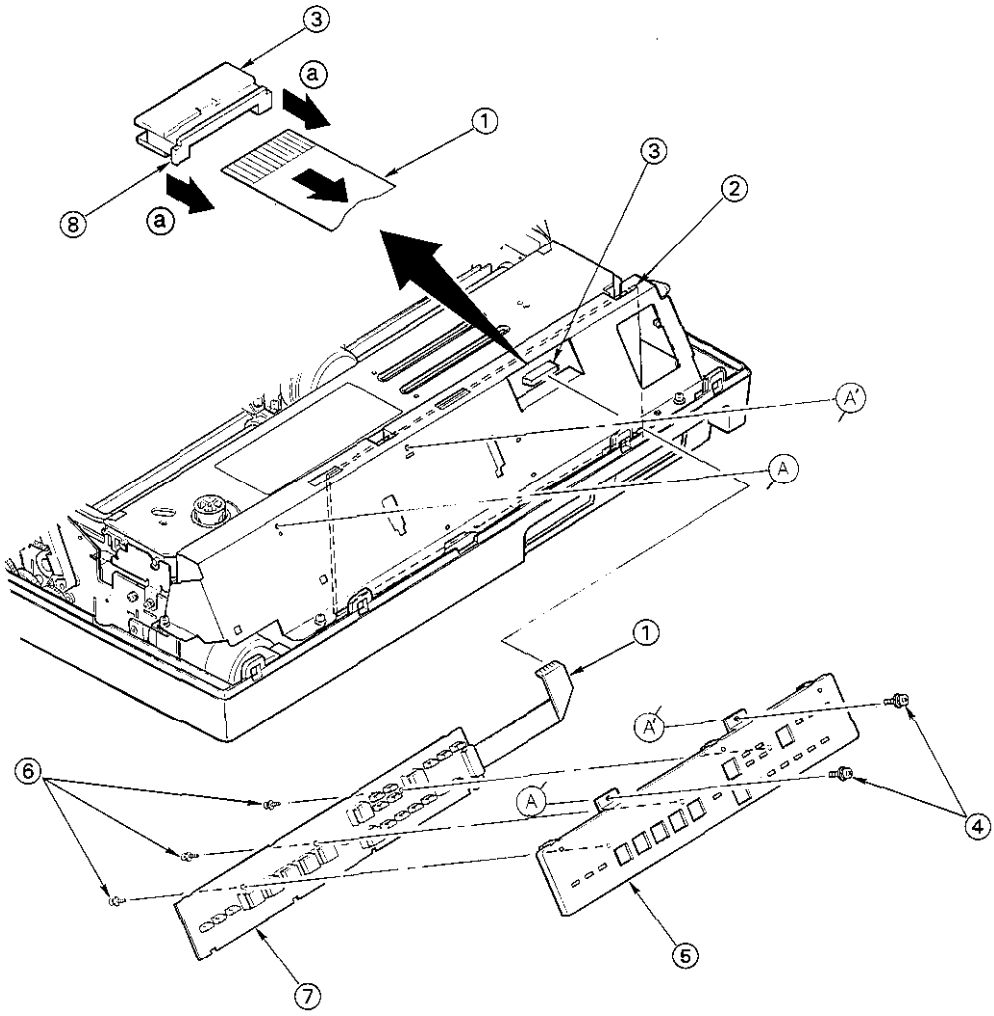
(5) **Remove three screws ⑥ .**

(6) **Remove operator panel ⑦ from operator panel holder ⑤ .**

(7) **To install, reverse the removal procedure sequence.**

[Note on installation]

(1) Insert the cab/e ① to the connector ③ and insert the locking piece ⑧ in the reversed direction of arrow a to fix the **cable ①**



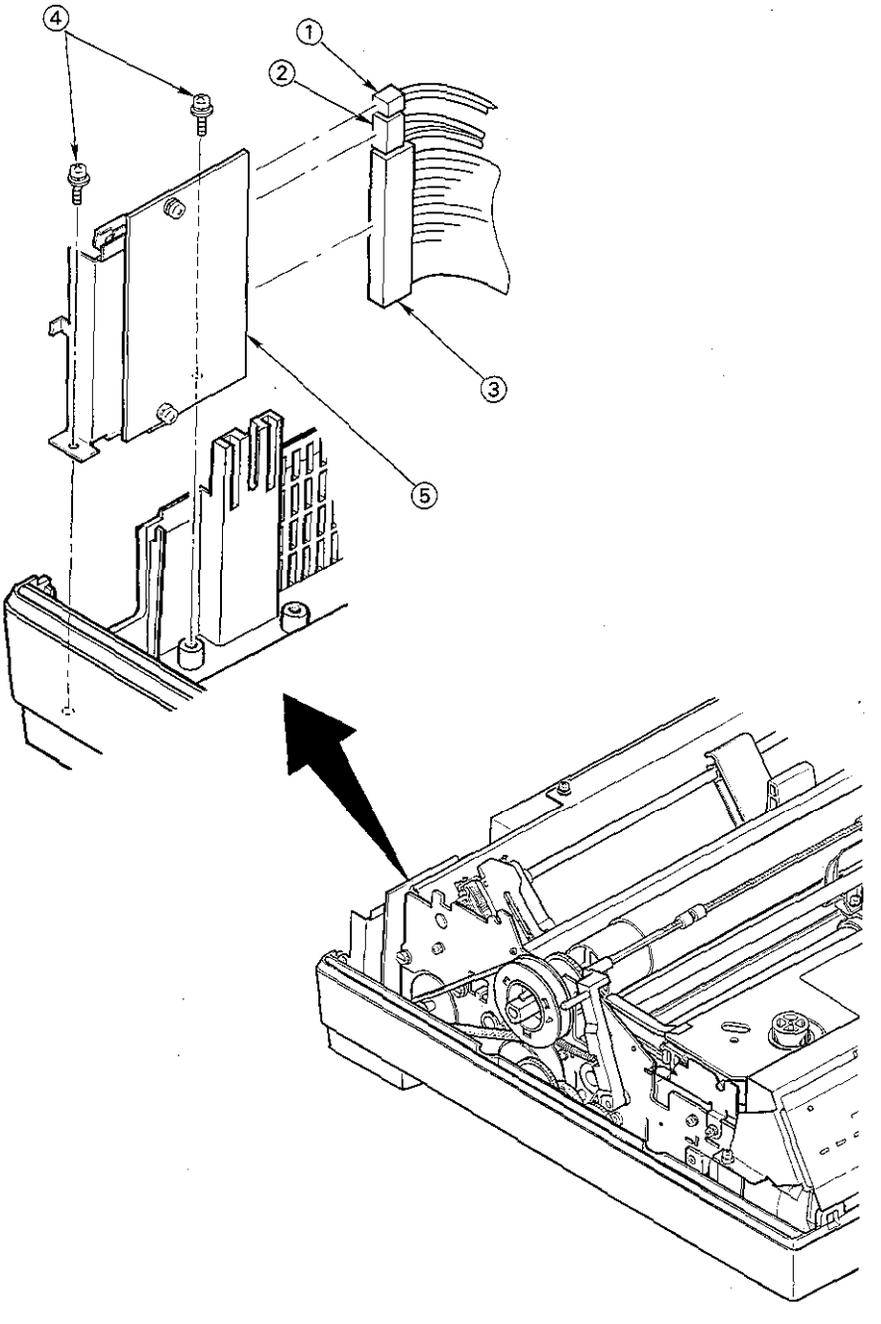
5.2.6 Interface Connector Board

(1) Remove the upper cover. (See section 5.2.4.)

(2) Disconnect cables ①, ② and ③.

(3) Remove two screws ④, and remove interface connector board ⑤ upward.

(4) To install, reverse the removal procedure sequence.



5.2.7 Control Board (LQMA)

(1) **Remove the upper cover. (See section 5.2.4.)**

(2) **Remove ribbon cartridge ①**

(3) **Remove personality cartridge ② and font cartridge ③.**

(4) **Release the lock of control board connector CN10 ④, and draw out cable ⑤ then cable ⑥.**

(5) **Remove five screws ⑦, and remove shield cover assembly ⑧.**

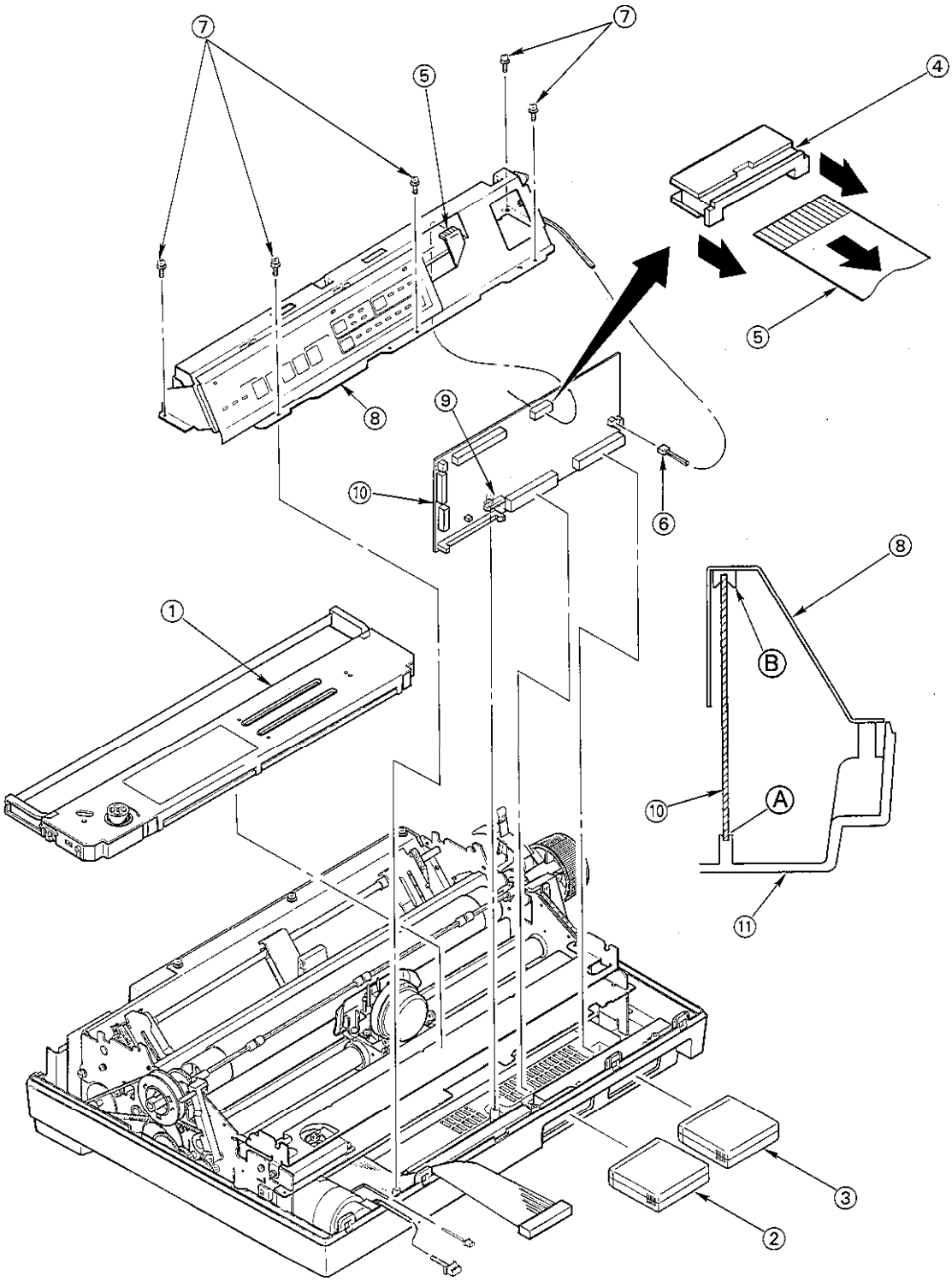
(6) **Loosen set screw ⑨, and remove all connectors (CN1 to 9) from control board ⑩ while lifting it slightly.**

(7) **Remove control board ⑩ upward.**

(8) **To install, reverse the removal installation procedure sequence.**

[Notes on installation]

(1) Do not allow the connecting cable to be caught under control board ⑩
(2) Insert control board ⑩ in groove Ⓐ on lower cover ⑪, and butt it on the right before tightening the set screw.
(3) Before fixing the shield cover. fit control board ⑩ in groove Ⓑ on it.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5.2.8 Printer Mechanism

(1) **Remove the control board (LQMA). (See section 5.2.7.)**

(2) **Disconnect cables CN102 ② and CN103 ③ connected to interface connector board ①**

(3) **Remove three screws ④.**

(4) **Remove three screws ⑤, and remove fitting ⑥ (three places).**

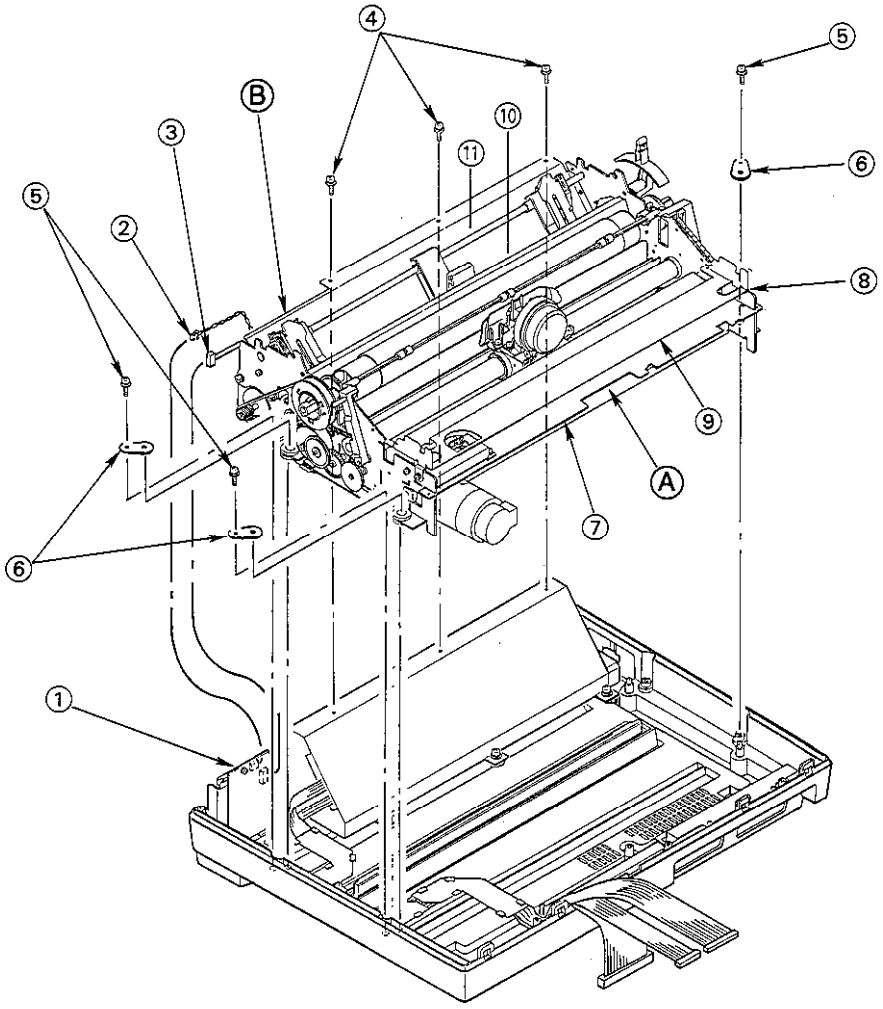
(5) **Holding the front side (portion Ⓐ) and rear side (portion Ⓑ) of base frame ⑦, lift it up vertically for removing printer mechanism ⑧.**

Do not hold ribbon cartridge bracket ⑨, paper shute ⑩ and guide shaft A ⑪ of the sheet feeder assembly when removing printer mechanism ⑧

(6) **To install, reverse the removal procedure sequence.**

[Note on **installation]**

(1) Do not allow the cables and connectors to be caught under printer mechanism.



5.2.9 Platen Assembly

(1) **Remove the printer mechanism. (See section 5.2.8.)**

(2) **Loosen three bolts ① , move LF motor ② close to platen ⑮ , and remove line feed belt ③**

(3) **Remove "E" snap ring ④ , and remove washer A ⑤ , spring ⑥ and idle gear ⑦ .**

(4) **Remove screw ⑧ , and remove gear pulley ⑨ , washer B ⑩ and bearing ⑪ .**

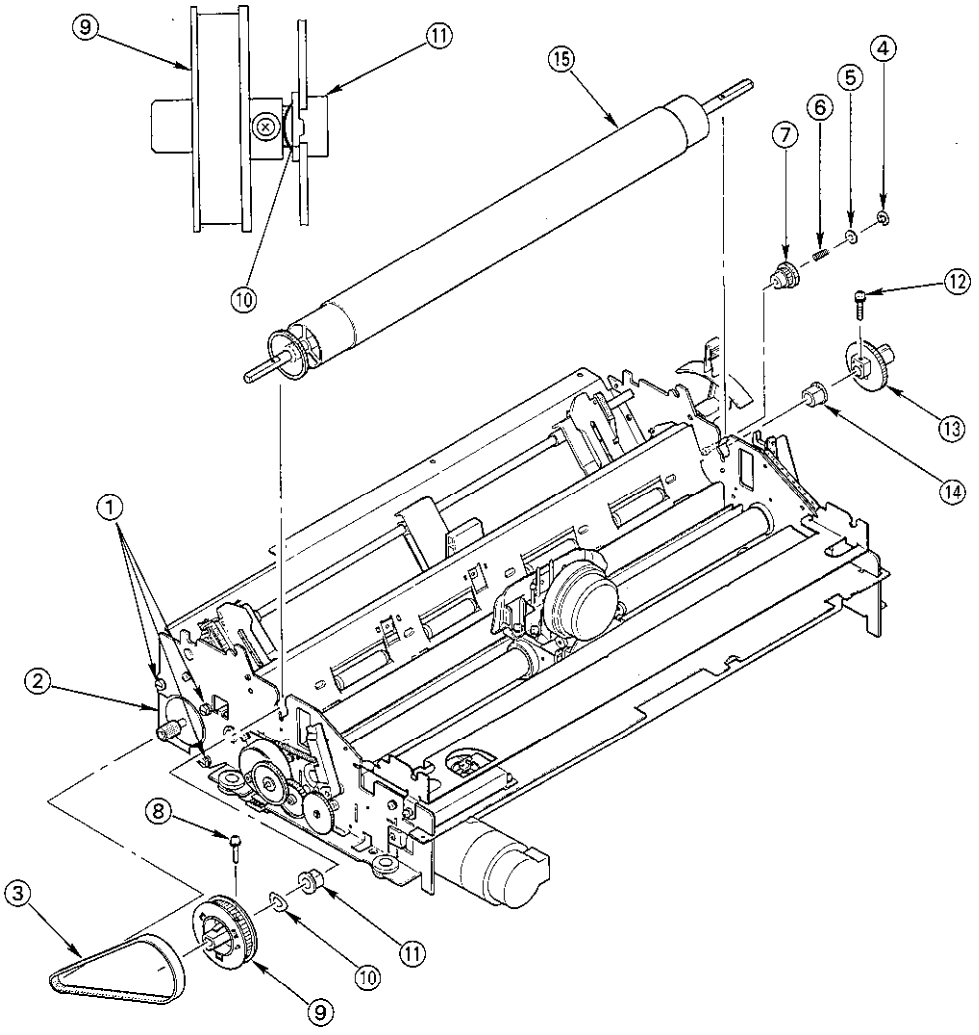
(5) **Remove screw ⑫ , and remove gear ⑬ and bearing ⑭**

(6) **Take out the platen assembly ⑮ .**

(7) **To install, reverse the removal procedure sequence.**

[Notes on installation]

(1) Be sure to install correctly washer B ⑩
(2) Be sure to adjust the be/t tension after installing line feed be/t ③ **(See section 6.5.)**



5.2.10 line Feed Motor Assembly

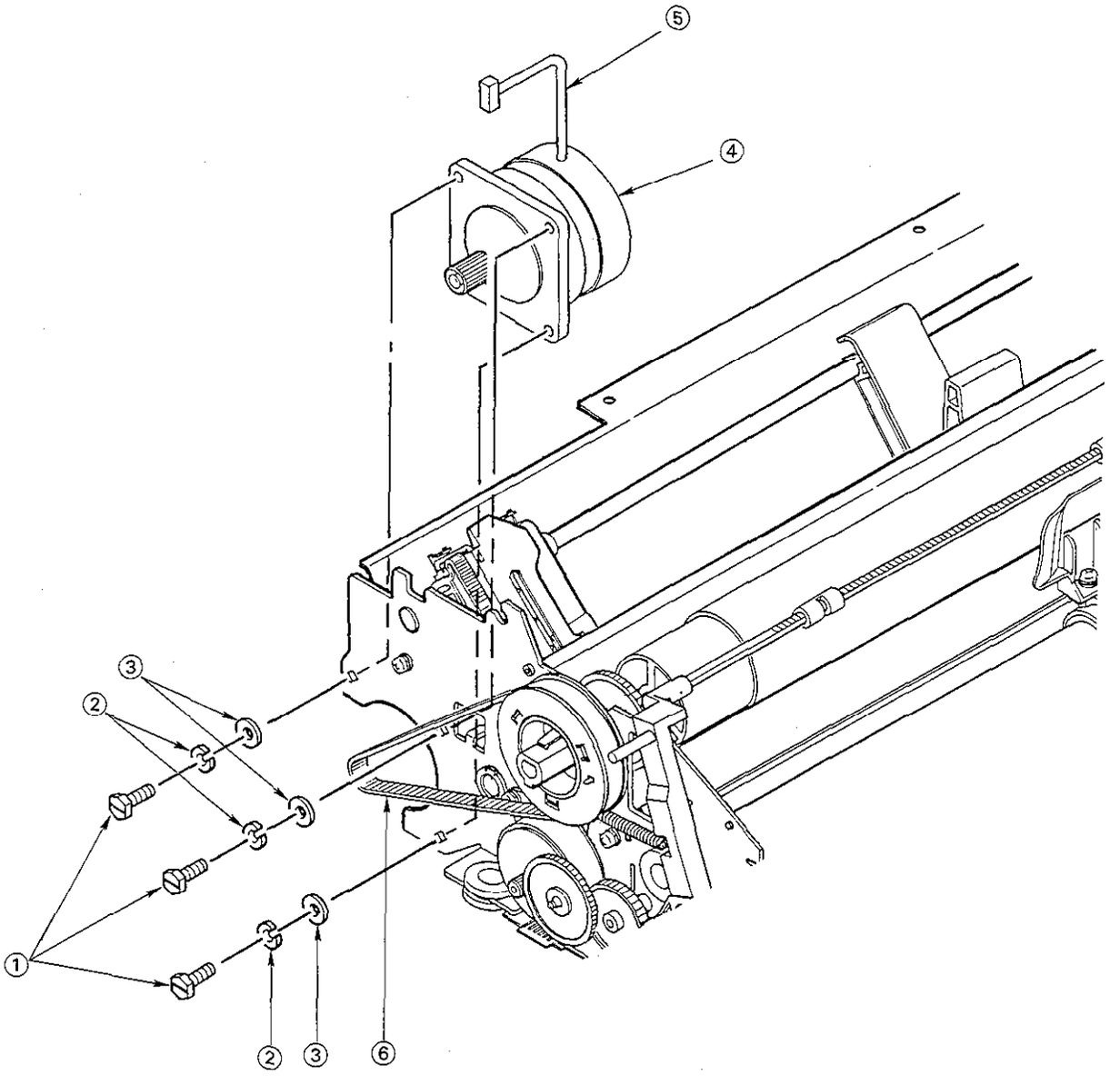
(1) **Remove the printer mechanism. (See section 5.2.8.)**

(2) **Remove three bolts ① , three spring washers ② , and three washers ③ , then remove line feed motor ④**

(3) **To install, reverse the removal procedure sequence.**

[Notes on *installation]*

(1) Pay attention to the orientation of cable ⑤ extending out of line feed motor ④
(2) Adjust line feed belt ⑥ tension after installing line feed motor ④ (See section 6.5.)



5.2.11 Head Cable Assembly

(1) **Remove the print head. (See section 5.2.1.)**

(2) **Remove the printer mechanism. (See section 5.2.8.)**

(3) **Remove two screws ① , and remove cartridge bracket ② .**

(4) **Remove screw ③ , and remove connector clamp ④**

(5) **Remove head cable connector ⑤ from carriage frame ⑥ .**

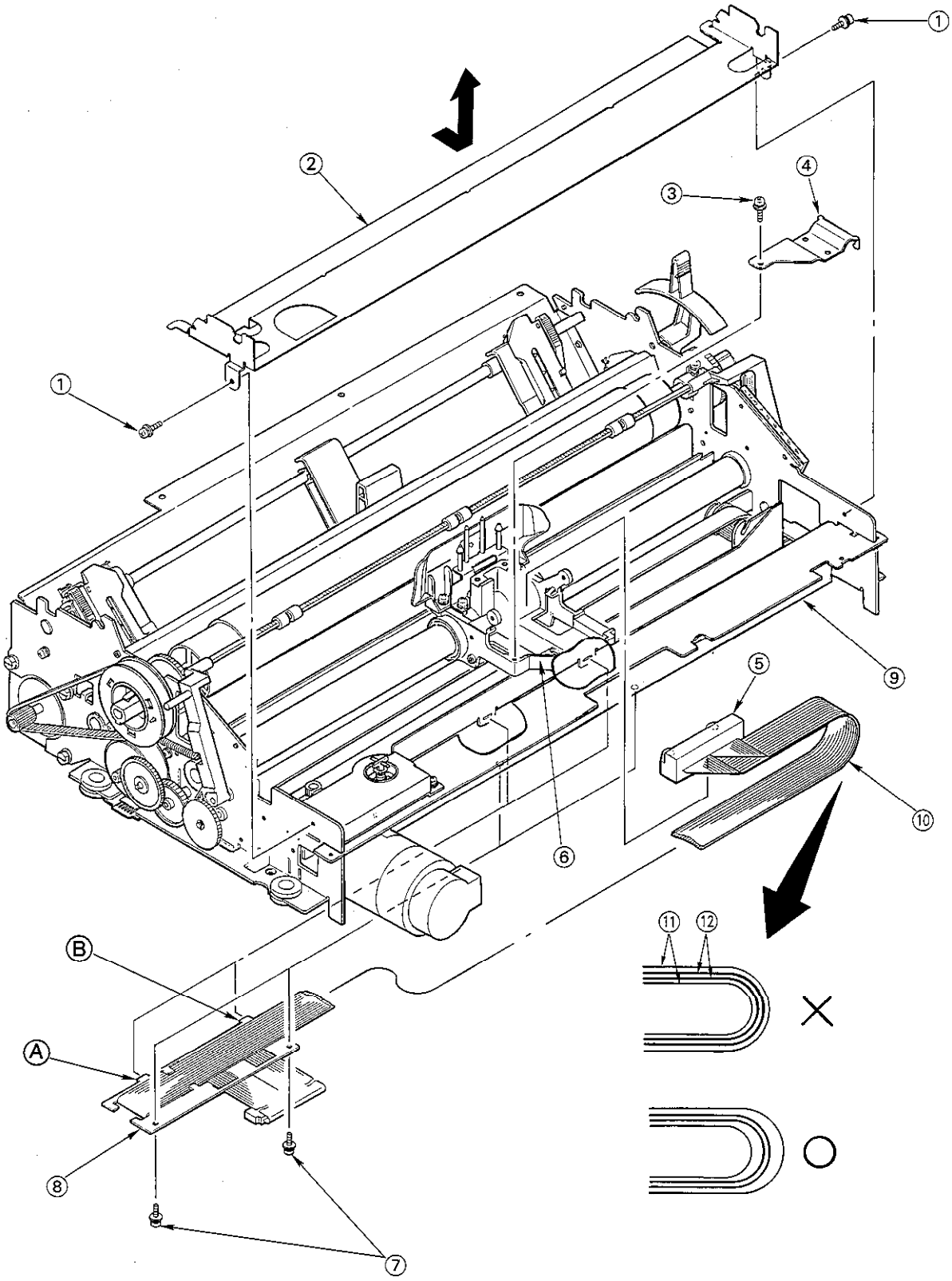
(6) **Remove two screws ⑦ , and remove the hooks (Ⓐ, Ⓑ) of the cable clamp ⑧ off base frame ⑨ .**

(7) **Remove head cable assembly@ by pulling downward while slightly lifting up the front end of the printer mechanism.**

(8) **To install, reverse the removal procedure sequence.**

[Note on installation]

(1) Be sore to install cable guide ⑪ so that some clearance will be left between head cab/e ⑫ at the bent portion.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5.2.12 Sensor Board

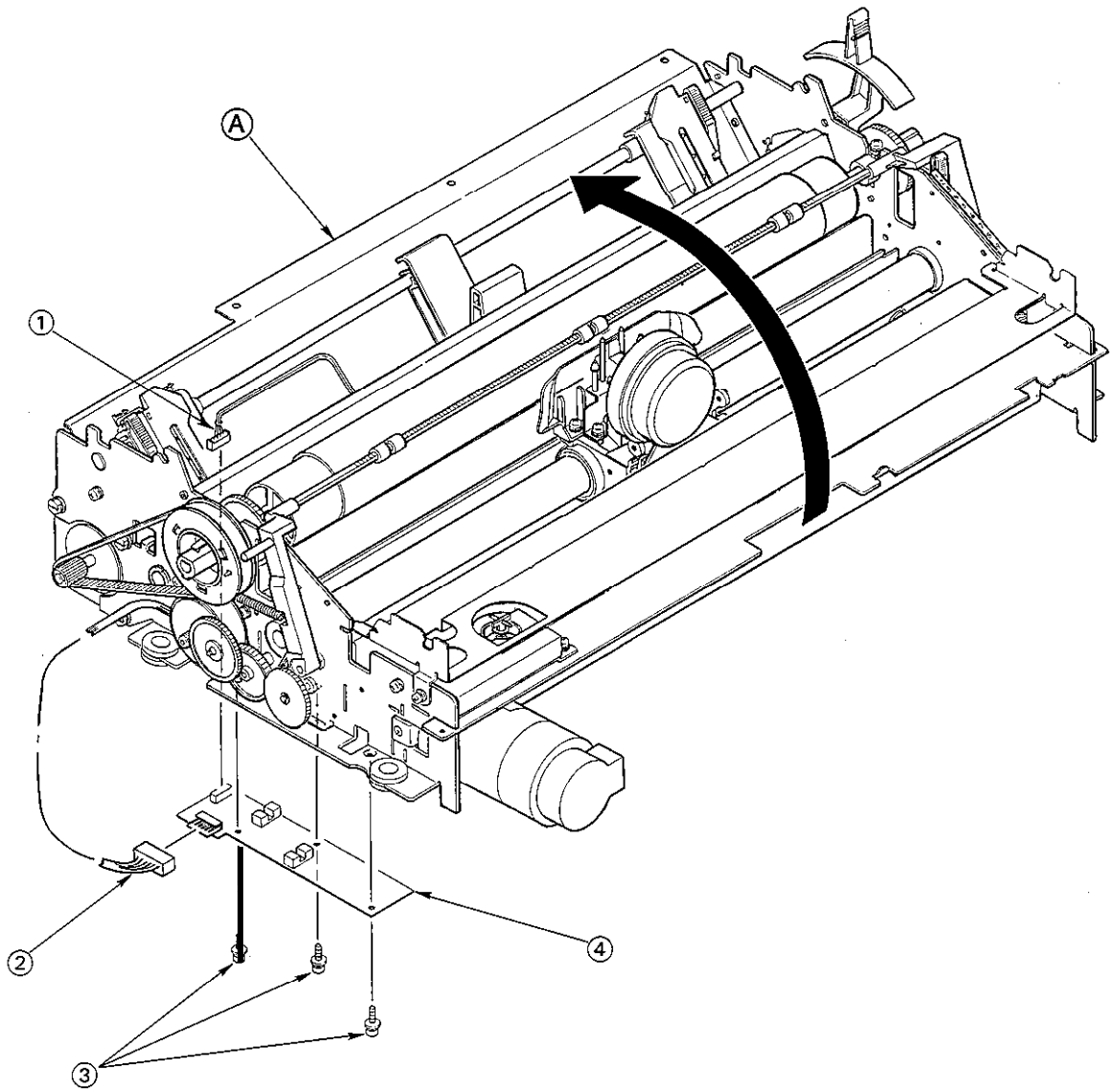
(1) **Remove the printer mechanism. (See section 5.2.8.)**

(2) **Disconnect cables CN1① and CN2 ② connected to sensor board ④ .**

(3) **Raise the printer mechanism by 90° using its portion Ⓐ as a supporting point.**

(4) **Remove three screws ③ , and remove sensor board ④ .**

(4) **To install, reverse the removal procedure sequence.**



5.2.13 Ribbon Feed Assembly

(1) **Remove the printer mechanism. (See section** 5.2.8.)

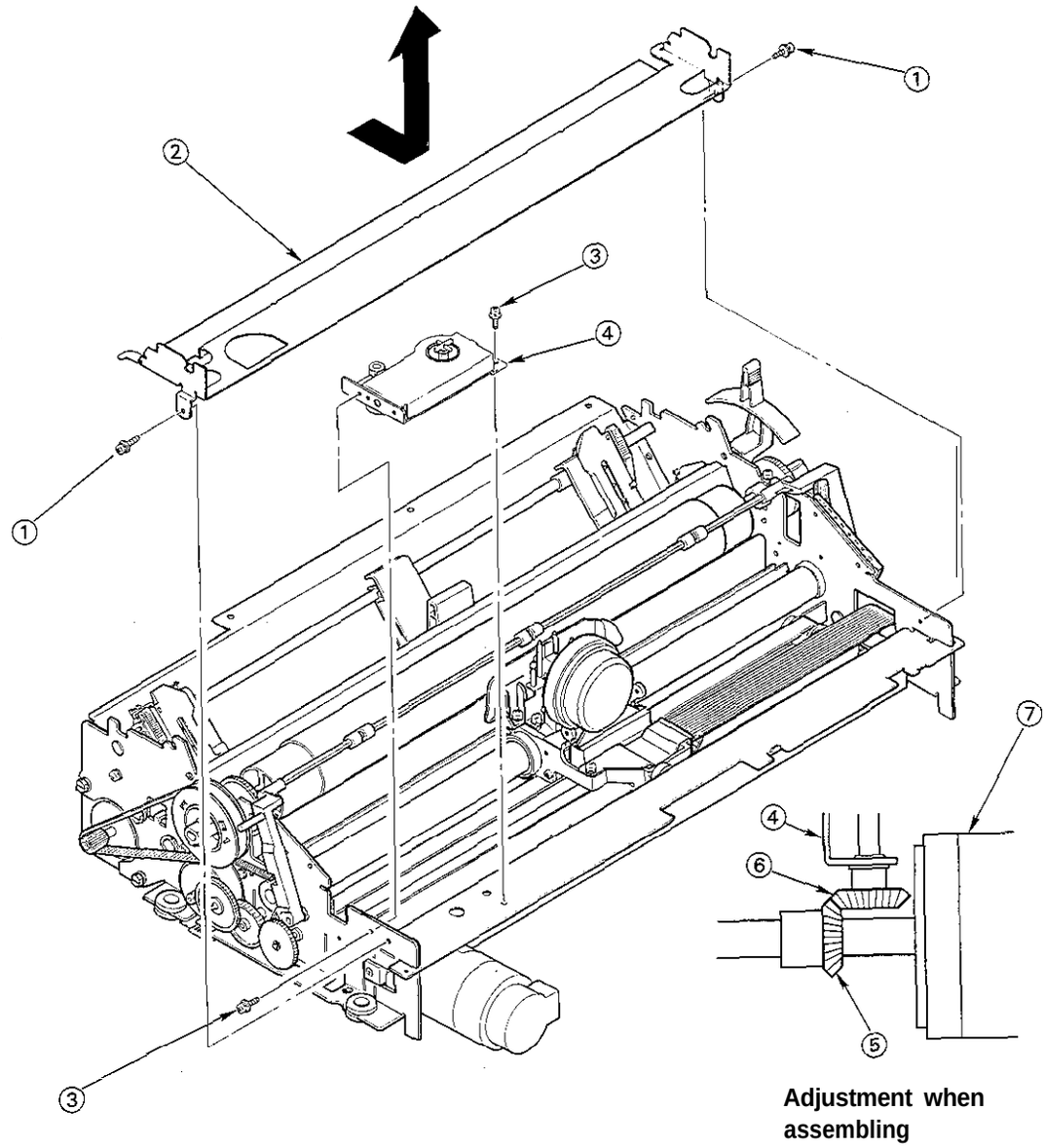
(2) **Remove two screws** ① **, and remove cartridge bracket** ② **by pulling it to the front.**

(3) **Remove two screws** ③ **, and remove ribbon feed assembly** ④

(4) **To** install, reverse **the removal procedure sequence.**

[Note on *installation]*

(1) Adjust the backlash between bevel gear ⑤ *of space motor* ⑦ *and bevel gear* ⑥ *Of ribbon feed assembly* ④ *(See section 6.4.)*



Adjustment when assembling

5.2.14 Space Motor Assembly

(1) **Remove the ribbon feed assembly. (See section 5.2.13.)**

(2) **Loosen two screws ① , press belt pulley bracket ② to the left to slacken space belt ⑤ , then tighten screws ① temporarily.**

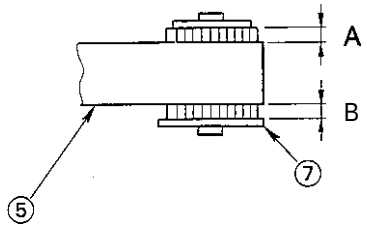
(3) **Remove two screws ③ .**

(4) **Draw out space motor ④ forward.**

(5) **To install, reverse the removal procedure sequence.**

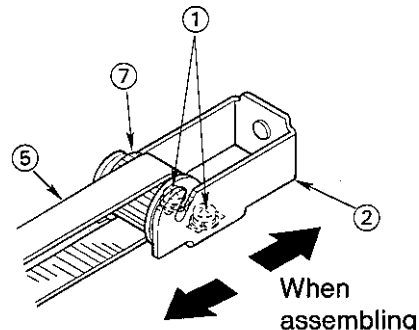
[Notes on installation]

(1) After installing space motor ④ , loosen screws ① and tense space be/t ① , then partially tighten screws ①
(2) Adjust the position of pulley bracket ② so that space be/t ⑤ is positioned at the center of be/t pulley ⑦ when carriage frame ⑥ is moved left and right by hand, before tightening the screws.
(3) Adjust the backlash of bevel gears, ⑧ , ⑩ of space motor assembly ④ and ribbon feed assembly ⑨ (See section 6.4.)

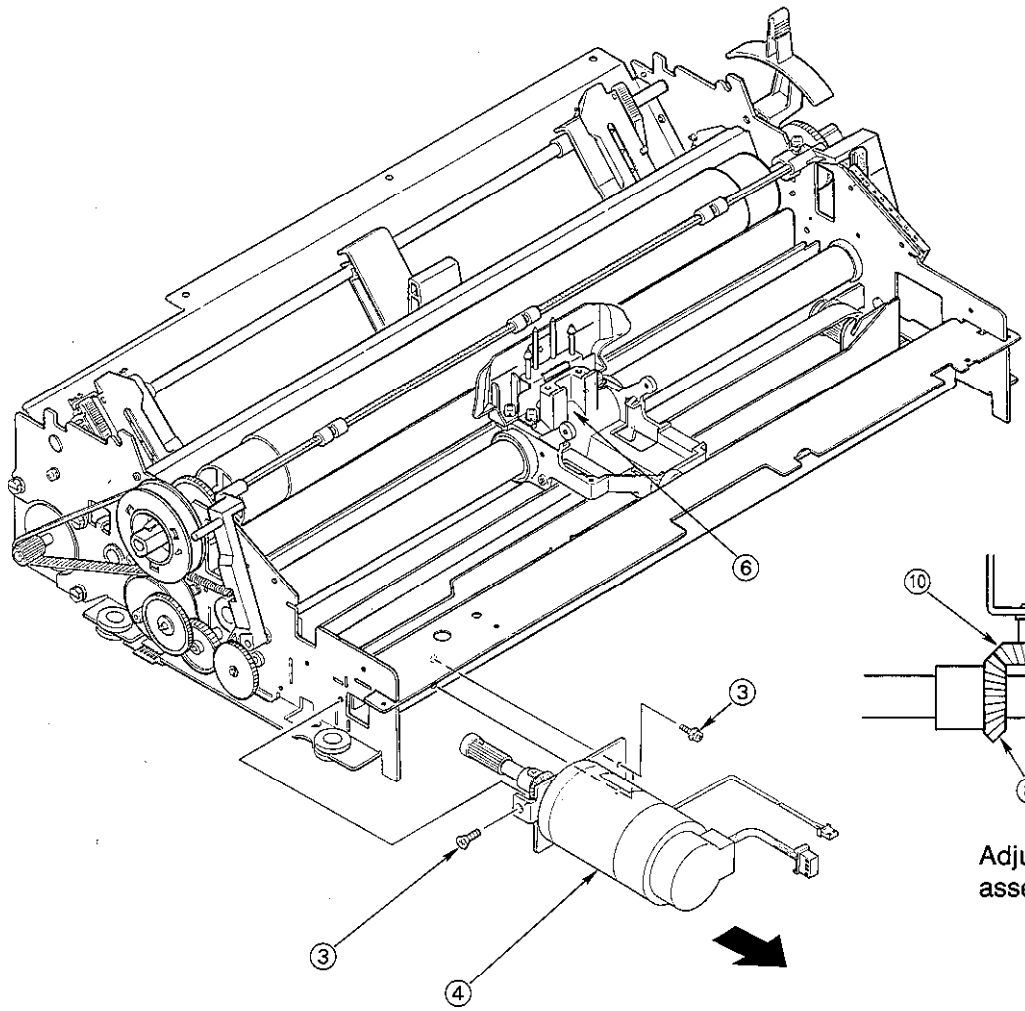


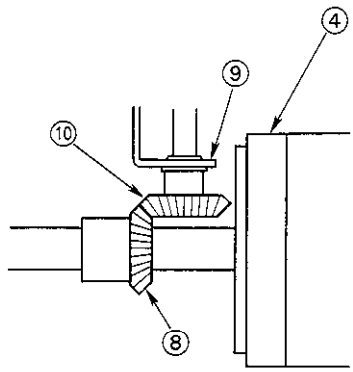
When assembling

A must be equal to B.



When disassembling





Adjustment when assembling.

5.2.15 Space Belt

(1) **Remove the space motor assembly. (See section 5.2.14.)**

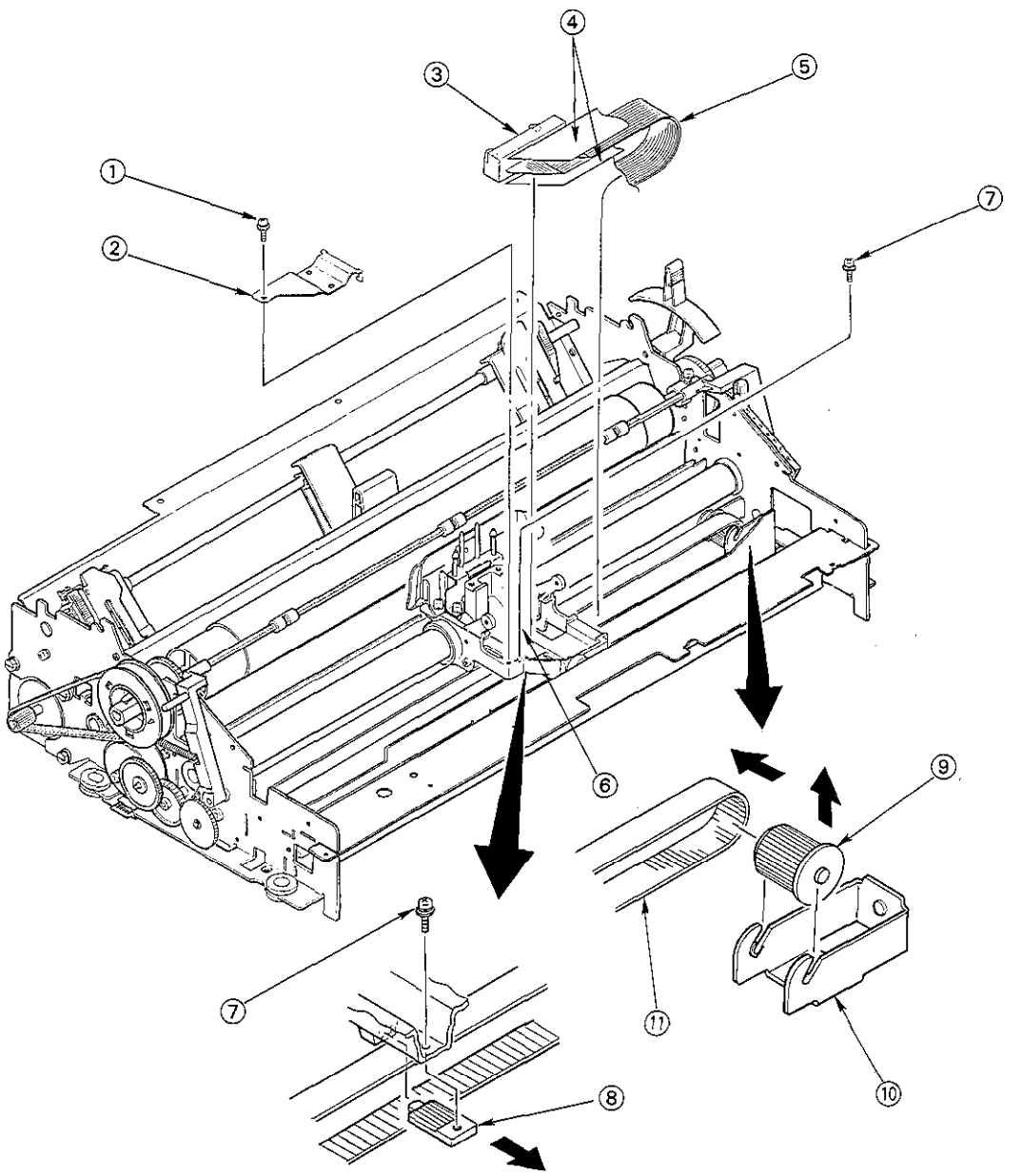
(2) **Remove screw ① and connector clamp ② .**

(3) **Remove connector ③ , cable guide ④ and head cable ⑤ from carriage frame ⑥**

(4) **Remove screw ⑦ and belt clamp ⑧ .**

(5) **Remove idle pulley ⑨ from idle pulley bracket ⑩ and remove space belt ⑪ .**

(6) **To install, reverse the removal procedure sequence.**



5.2.16 Bail/Ribbon Motor Assembly

(1) **Remove the printer mechanism. (See section 5.2.8.)**

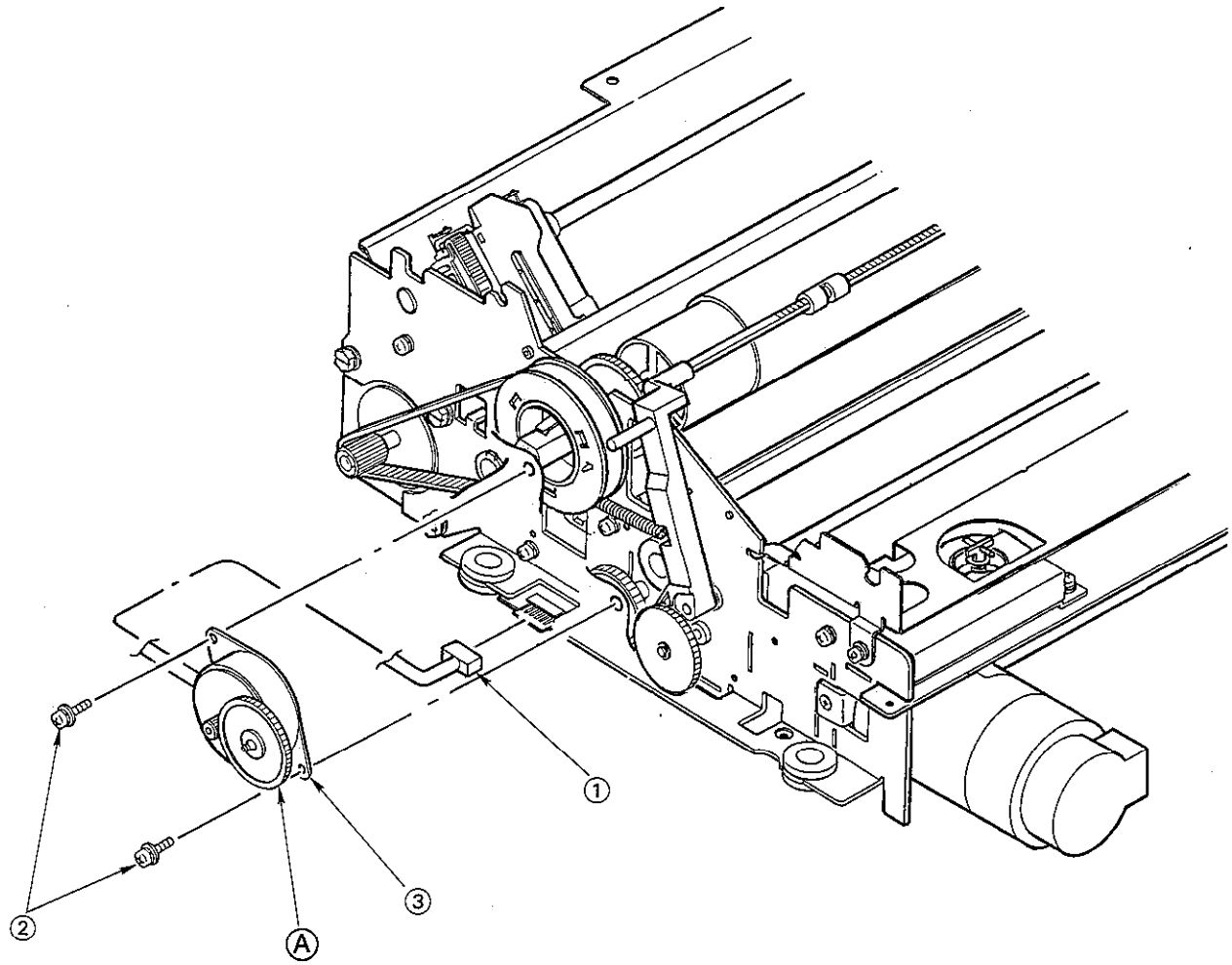
(2) **Disconnect cable CN15 ① .**

(3) **Remove two screws ② , and remove bail/ribbon motor assembly ③ .**

(4) **To install, reverse the removal procedure sequence.**

[Note on installation]

(1) Adjust the back/ash of gear Ⓐ. (See section 6.3.)



5.2.17 Paper Bail Assembly

(1) **Remove the bail/ribbon motor assembly. (See section 5.2.16.)**

(2) **Remove two springs ① .**

(3) **Remove idle gear ② .**

(4) **Remove one "E" snap ring ③ , and remove bail open cam ④**

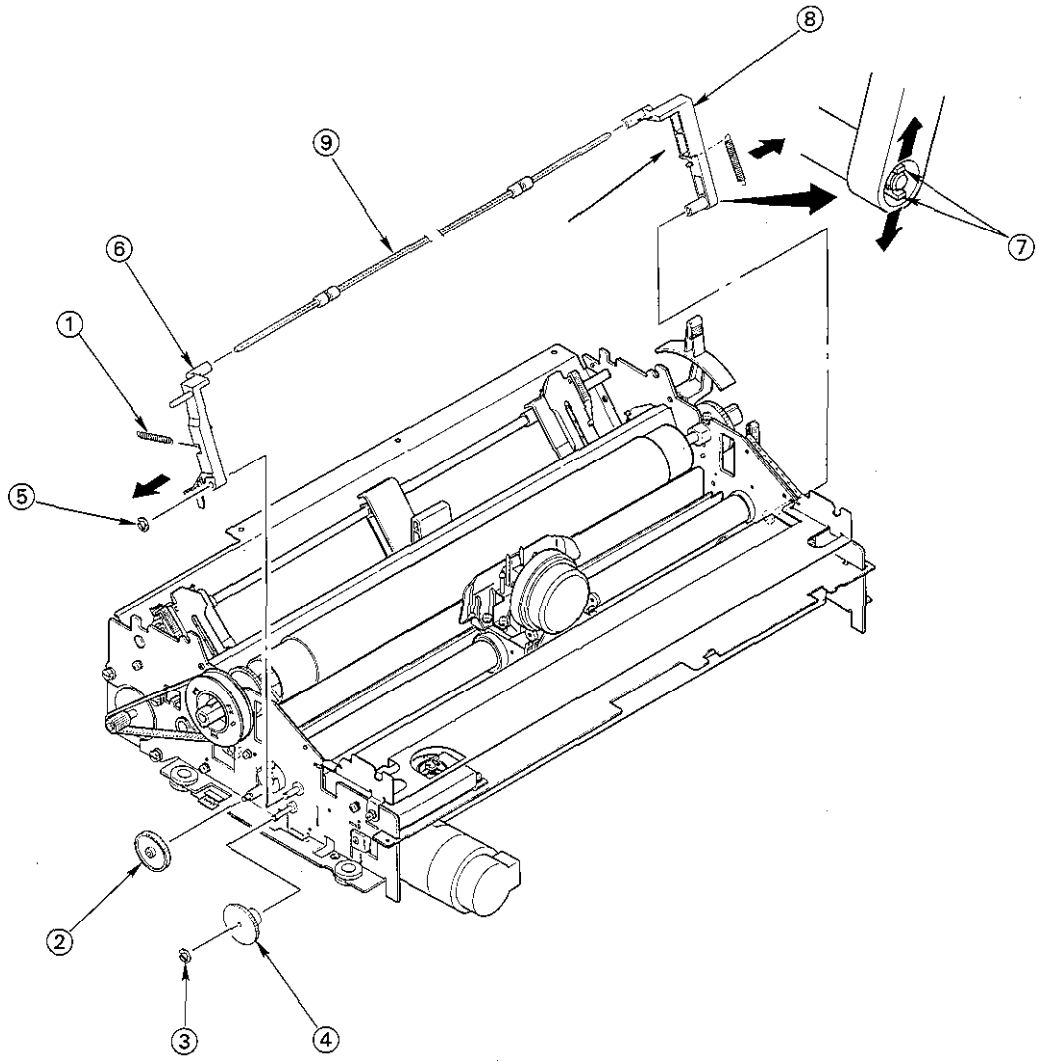
(5) **Remove one "E" snap ring ⑤ , and remove bail arm L ⑥ to the left while drawing it from paper bail bar ⑨**

(6) **Remove bail arm R ⑧ to the right while expanding clamp ⑦ outward.**

(7) **To install, reverse the removal procedure sequence.**

[Note on installation]

(1) **Since the** *shape of the spring ① for the fight side is different from that for the left side, be careful not to install the spring ① for the right side to the left side and that for the left side to the right side.*



5.2.18 Push Tractor Assembly

(1) **Remove the bail/ribbon motor assembly. (See section 5.2.16.)**

(2) **Remove center guide** *lower* ① **.**

(3) **Remove gear A ② by expanding its clamp Ⓐ in the direction of the arrow, and draw out guide shaft B ③ .**

(4) **Remove gear B ④ by expanding its clamp Ⓐ in the direction of the arrow, and draw out guide shaft C ⑤ Center guide upper ⑥ , friction piece ⑦ will come off together.**

(5) **Disconnect paper end micro switch cable connector ⑨ of push tractor assembly(L) ⑧ and cable clamp ⑩ from base frame ⑪ .**

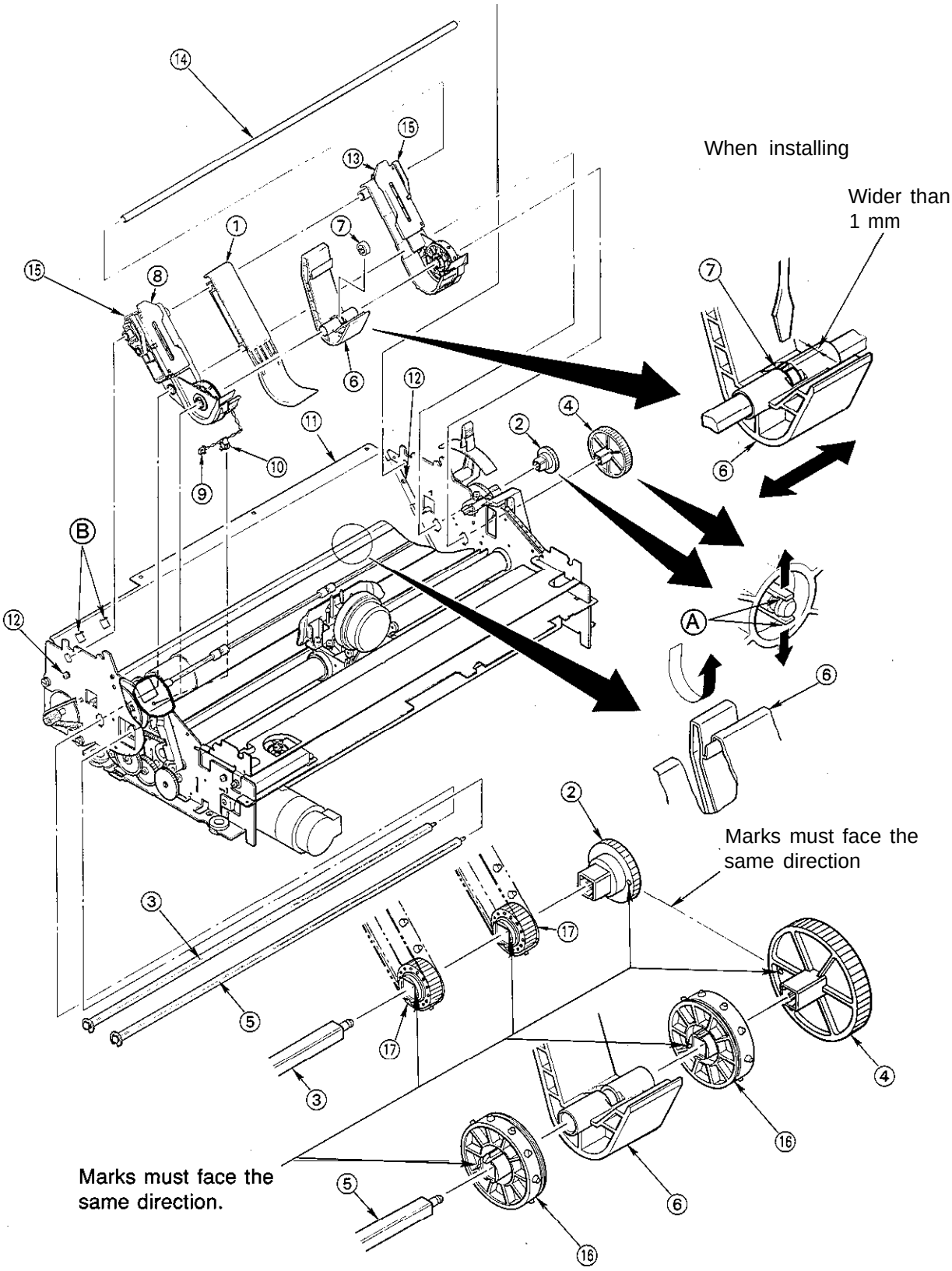
(6) **Loosen two screws ⑫ on left and right side, then remove push tractor assembly(L) ⑧ and (R) ⑬ , together with guide shaft A ⑭**

(7) **Loosen lock lever ⑮ , then draw out push tractor assembly (L) ⑧ and (R) ⑬ .**

(8) **To install, reverse the removal procedure sequence.**

[Notes for installation]

(7) Install push tractor assembly (L) ⑧ fitted correctly between two projections Ⓑ.
(2) Install guide shaft B ③ and C ⑤ by the following procedure:
(a) Set the projections of left and right pin tractor wheel ⑯ and a ho/e of gear B ④ to face the same direction. Then insert guide shaft C ⑤
(b) Set the projections of left and right pin tractor wheel ⑰ to face the same direction and insert guide shaft B ③
(c) Set the projections of left and right pin tractor wheel ⑰ and a ho/e of gear A ② to face the same direction, and engage gears A ② and B ④ by setting the holes on them to face each other. Then install gear A ② on guide shaft B ③
(3) Install friction piece ⑦ into guide shaft C ⑤ Then rotate it by 45° with standard screwdriver to give friction. (Try to slide center guide upper ⑥ left and right: If friction is felt, installation is correct; if it s/ides smoothly, installation is incorrect.)


When installing
Wider than
1 mm
Marks must face the
same direction
Marks must face the
same direction.

5.2.19 Power Supply Unit

(1) **Remove the printer mechanism. (See section 5.2.8.)**

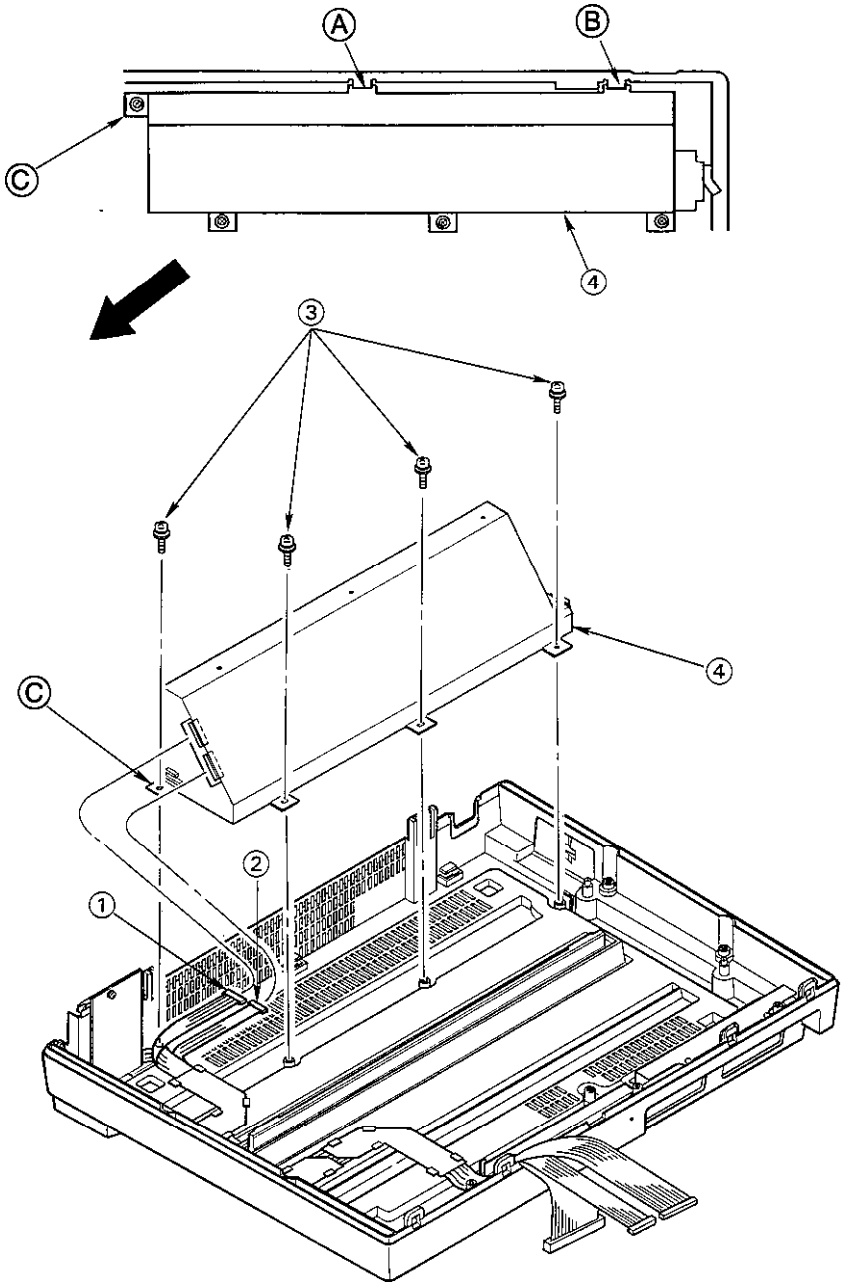
(2) **Disconnect two cables ① and ② from the left side face of power supply unit ④.**

(3) **Remove four screws ③.**

(4) **Draw out power supply unit ④ toward the left front while raising it a little so that it will come off guides Ⓐ and Ⓑ of the lower cover.**

Do not damage cables ①, ② with portion Ⓒ of power supply unit ④

(5) **To install, reverse the removal procedure sequence.**



5.3 Assembly/Disassembly Procedure for Color Model

The assembly replacement procedure for color model is explained in the following disassembly sequence.

- 5.3.1 Ribbon shift arm and shift arm spring
- 5.3.2 Roller lever
- 5.3.3 Ribbon guide
- 5.3.4 Bail open cam and bail open gear
- 5.3.5 Ribbon shift cam and ribbon shift gear
  - 5.3.6 Ribbon shift cam lever assembly

5.3.1 Ribbon Shift Arm, and Shift Arm Spring

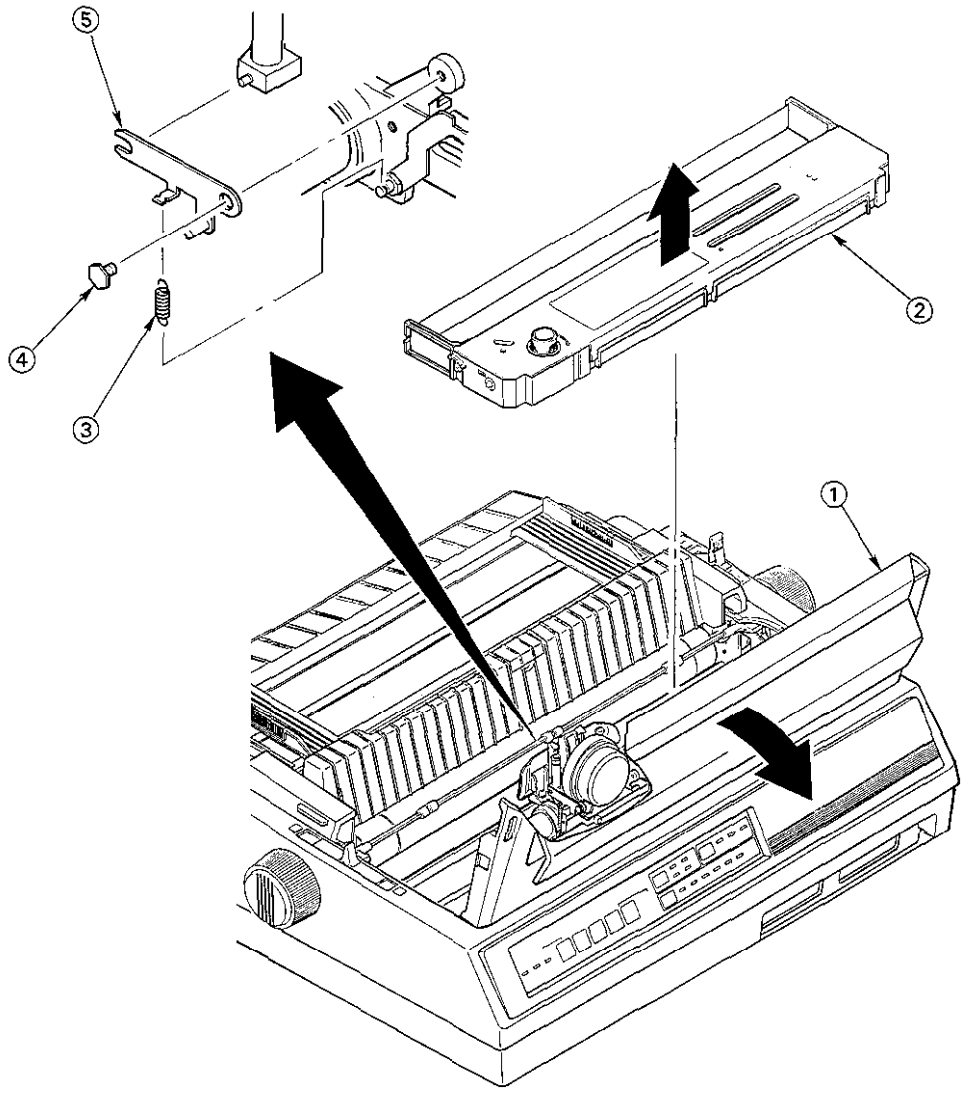
(1) Open access cover ①.

(2) Remove ribbon cartridge ②.

(3) Remove shift arm spring ③.

(4) Remove screw ④, and remove ribbon shift arm ⑤.

(5) To install, reverse the removal procedure sequence.



5.3.2 Roller lever

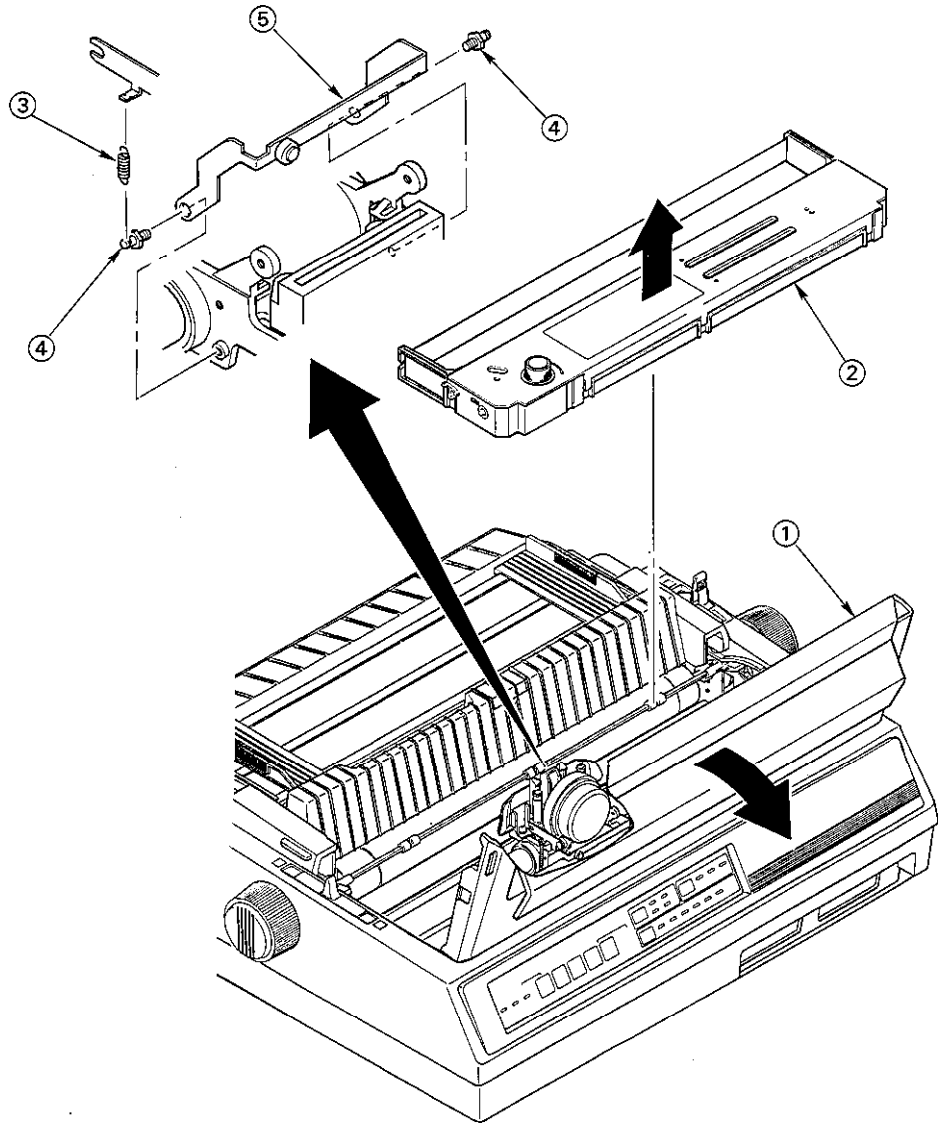
(1) Open access cover ①.

(2) Remove ribbon cartridge ②.

(3) Remove shift arm spring ③.

(4) Remove two screws ④, and remove roller lever ⑤.

(5) To install, reverse the removal procedure sequence.



5.3.3 Ribbon Guide

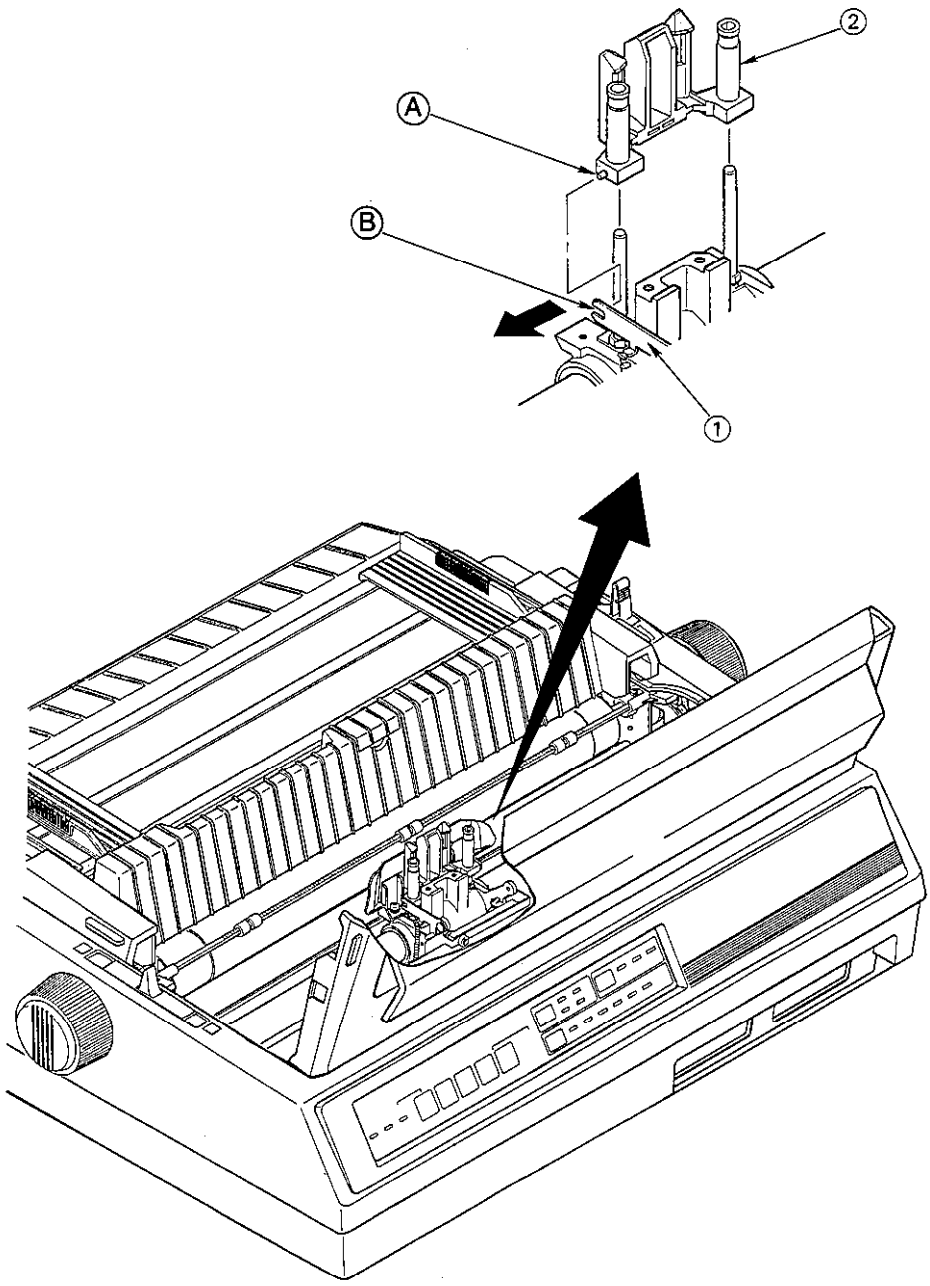
(1) **Remove the print head. (See section 5.2.1.)**

(2) **Draw out ribbon guide ② upward by first moving ribbon shift arm ① to the left, then removing it from projection Ⓐ of ribbon guide ② .**

(3) **To install, reverse the removal procedure sequence.**

[Note on *installation]*

(1) Fit the left side projection Ⓐ of ribbon guide ② into cutout portion Ⓑ at the end of ribbon shift arm ①



5.3.4 Bail Open Cam and Bail Open Gear

(1) **Remove the printer mechanism. (See section 52.8.)**

(2) **Remove "E" snap ring ① , and remove bail open gear ② and bail open cam ③ from shaft ④ . Fix the friction urethane foam ring ⑥ on the bail open cam ③ beforehand. (See Figure 1.)**

(3) **To install, reverse the removal procedure sequence.**

[Notes on *installation]*

(1) Installation may be easier if bail open cam ③ is installed first, and bail open gear ② is fitted next.
(2) Bail open cam ③ must be inserted info spring ⑤ .

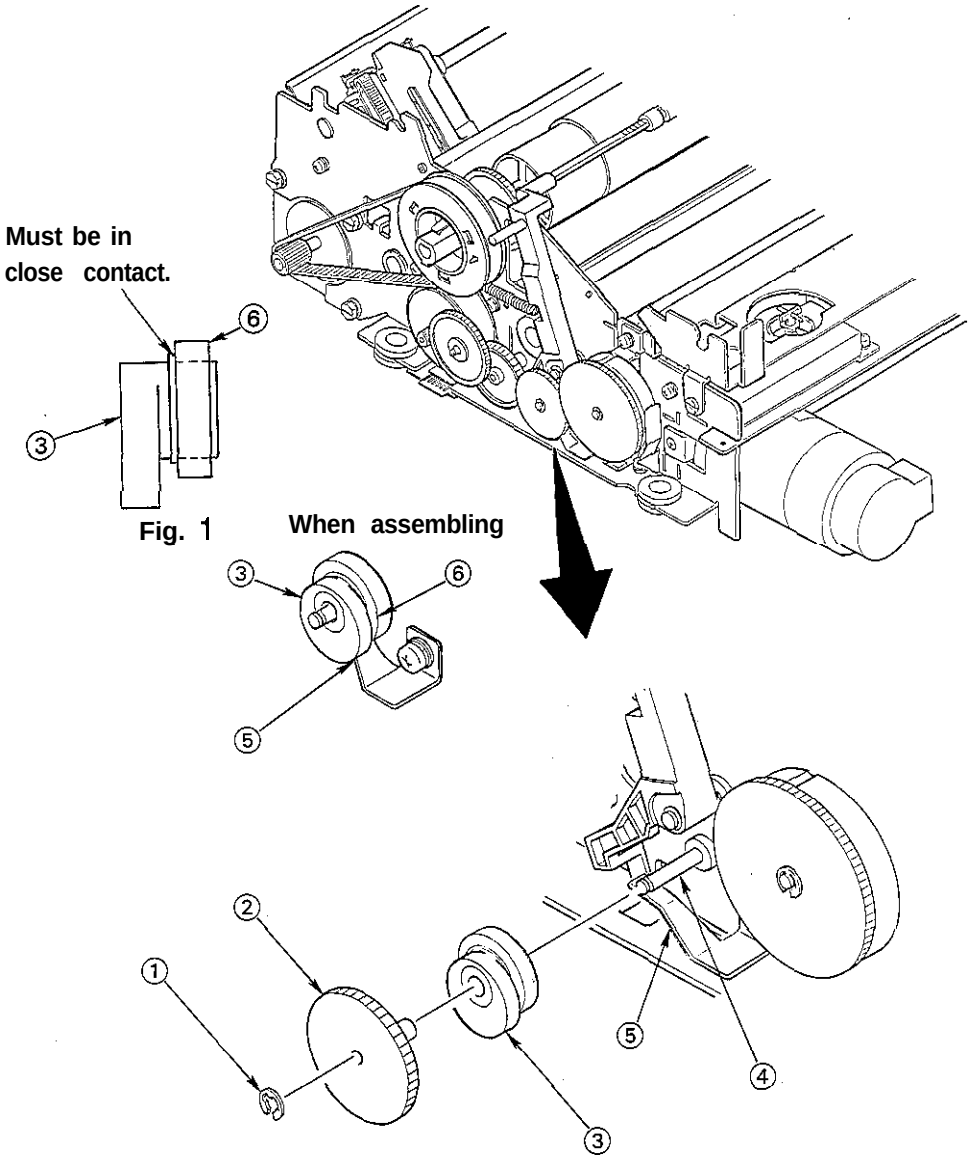


Fig. 1

5.3.5 Ribbon Shift Cam and Ribbon Shift Gear

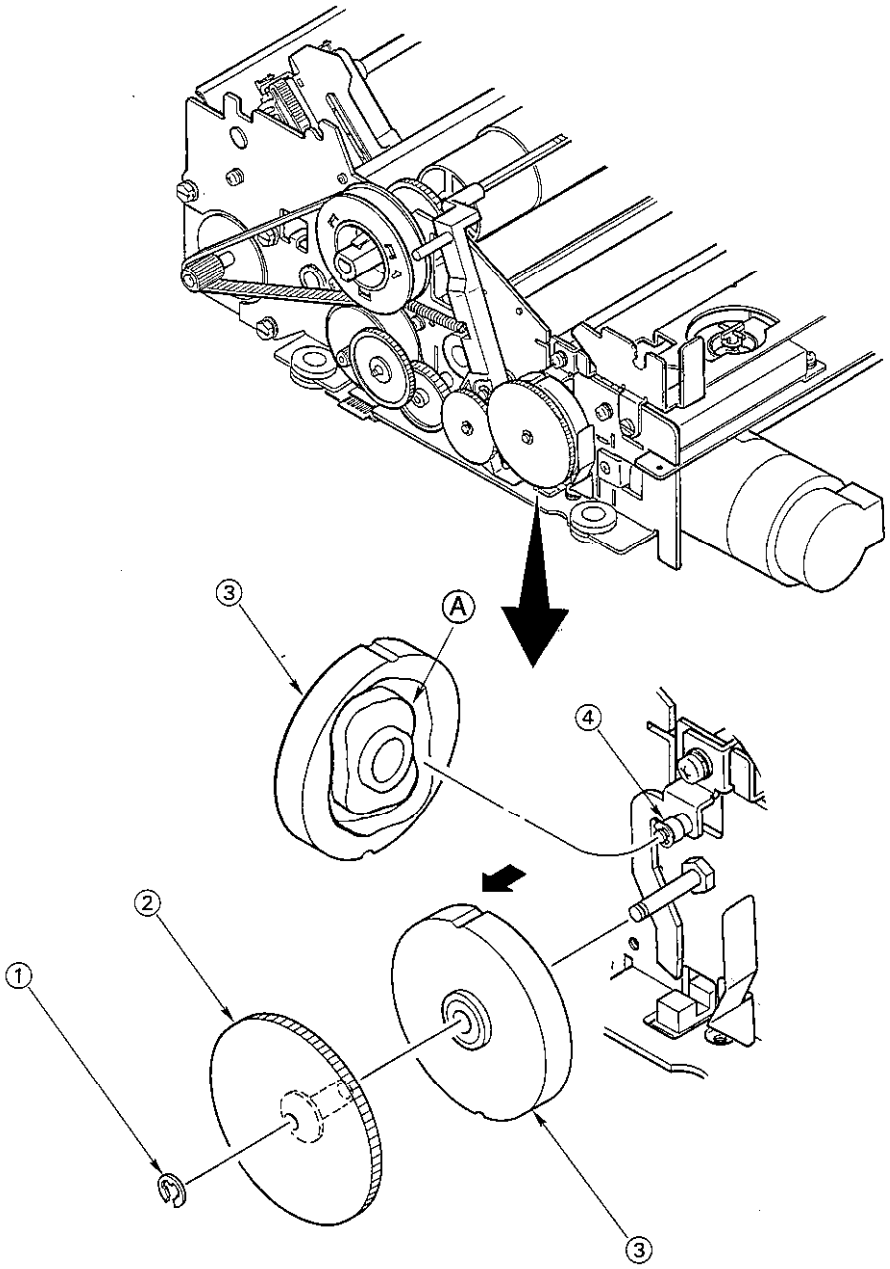
(1) **Remove the printer mechanism. (See section 5.2.8.)**

(2) **Remove "E" snap ring ① , then remove ribbon shift gear ② and ribbon shift cam ③**

(3) **To install, reverse the removal procedure.**

[Note on installation]

(1) Roller ④ must be pot in groove Ⓐ of ribbon shift cam ③ .



5.3.6 Ribbon Shift Cam Lever Assembly

(1) **Remove the printer mechanism. (See section 5.2.8.)**

(2) **Remove the ribbon shift cam and ribbon shift gear. (See section 5.3.5.)**

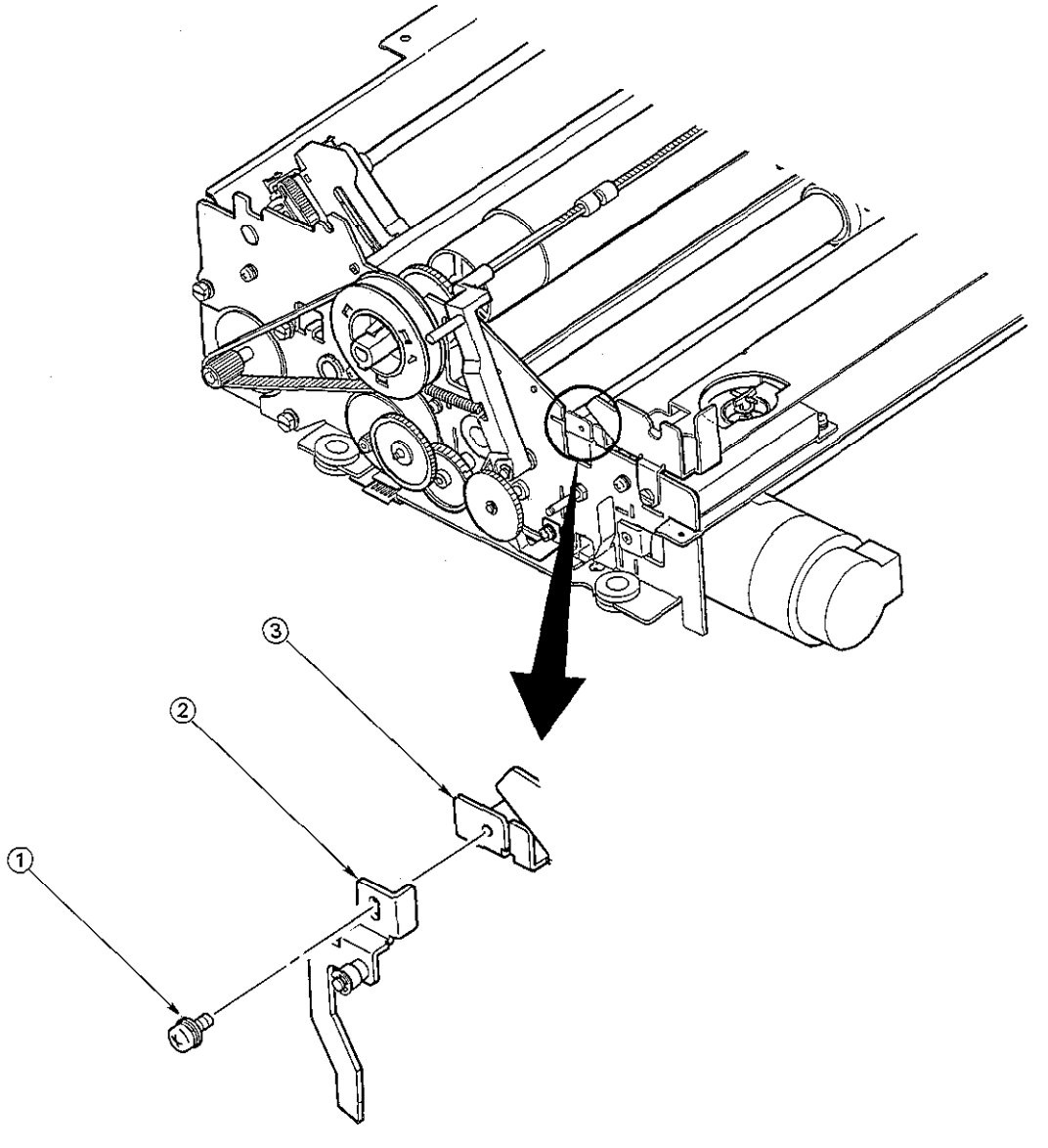
(3) **After removing screw ①, remove ribbon shift cam lever ② from cartridge bracket ③**

(4) **To install, reverse the removal procedure sequence.**

[Note on installation]

(1) **The** *following adjustment is needed when installing.*

Adjust the ribbon guide height and the gap between shift cam lever and color shift sensor. (See section 6.6.)



6. ADJUSTMENT

6. ADJUSTMENT

(1) **Be sure to carry out this adjustment with the printer mechanism mounted on the lower cover.**

(2) **Be sure to carry out this adjustment operation on a level and highly rigid work table (flatness: less than 0.039 inch or 1 mm) so as to minimize adjustment error.**

6.1 Gap Between Platen and Printhead

(1) **Adjusting position**

Perform adjustment at the three positions of left, center and right ends of the platen.

(2) **Adjustment value**

a = 0.017 20.001 inch (0.43 ± 0.03 mm)

(3) **Preparation for adjustment**

(a) Set the adjusting lever to range 1.

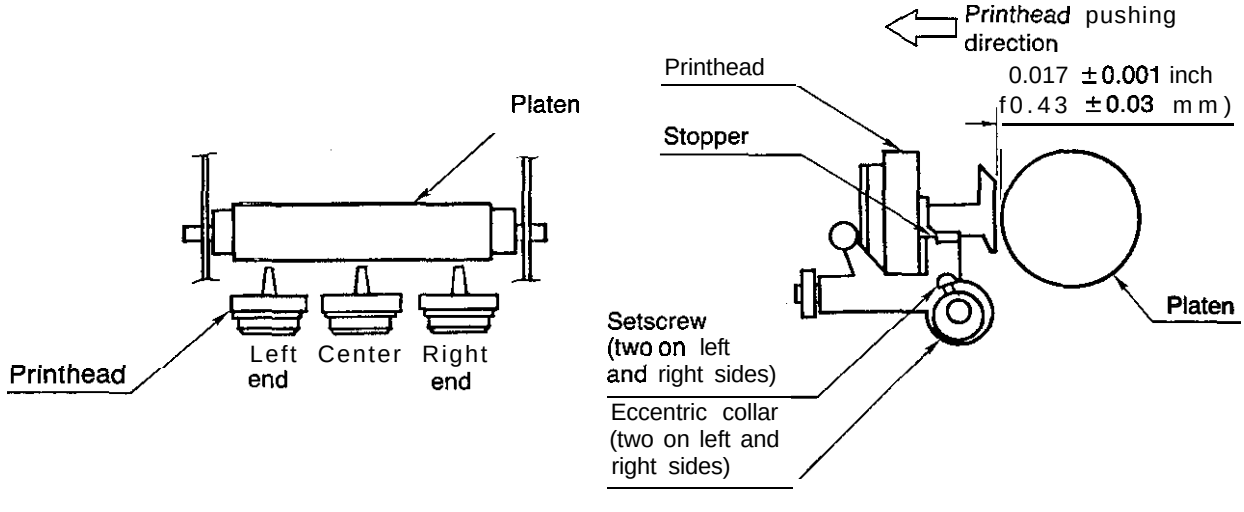
(b) **Set the release lever to "open".**

(c) **Remove the ribbon protector before adjustment.**

(4) **Adjusting procedure**

To adjust the gap, loosen the left and right eccentric collar setscrews, and rotate the collar until the correct gap is obtained.

Note: 1. Make sure that the printhead is fitted correctly to the stopper.



6.2 Adjustment of Gap between Ribbon Protector and Platen

(1) Adjustment value

ⓐ = (more than 0.14 mm) more than 0.06 inch
ⓑ = (0.1 to 0.18 mm) 0.04 to 0.07 inch
ⓒ = (0.1 to 0.2 mm) 0.04 to 0.08 inch
ⓓ = 0 ± 0.06 inch (0 ± 0.15 mm) .. (In the direction of left and right)

(2) Adjustment procedure

(a) Remove the access cover.

(b) Remove the ribbon cartridge.

- **Before making this adjustment, you should confirm that the adjustment of the gap between printhead and platen has been done. (Set the head gap adjusting lever to range 1.)**

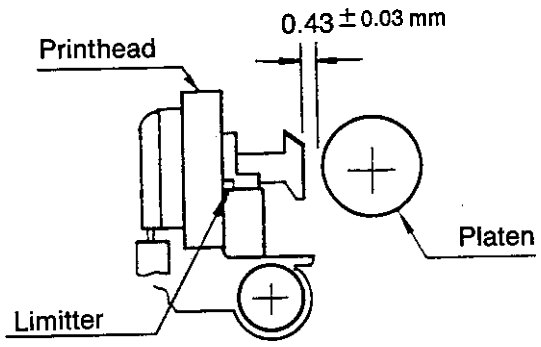
(c) Set the head gap adjusting lever at position No. 9.

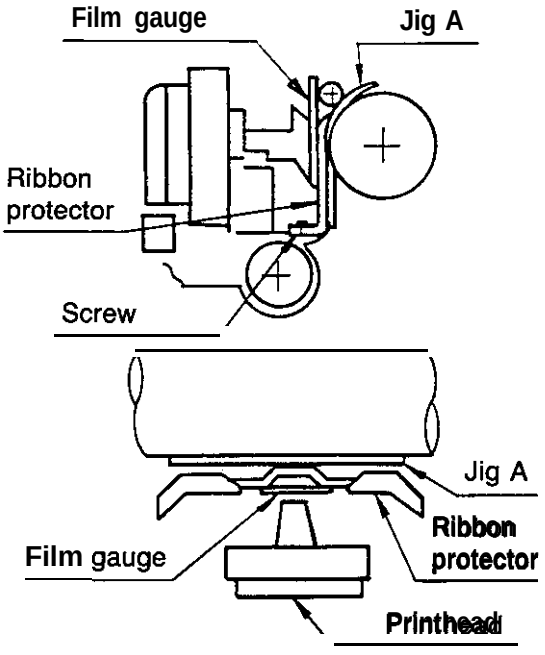
(d) Pull the bail openlever forward.

(e) Insert the ribbon protector gauge into the gap between platen and ribbon protector. And then, fix the ribbon protector gauge (jig A) backward to close the bail lever.

(f) Insert 7 sets of film gauge the gap between the tip of printhead and ribbon protebor.

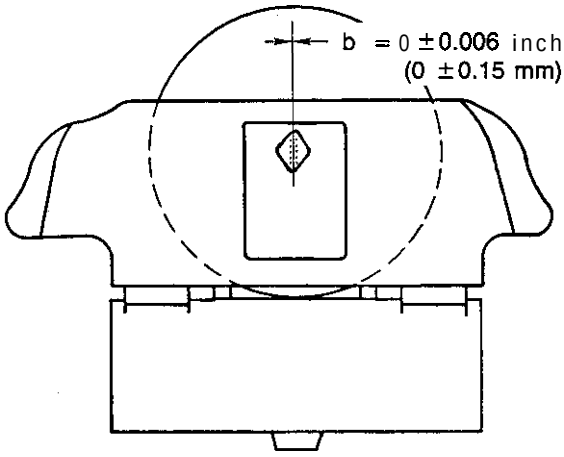
(g) Set the headgap adjusting lever at position No. 1.





(h) **Loose the screws for fixing the ribbon protector and softly shake it right and left so that ribbon protector be free from any pressures. And then, tighten the screws alternately.**

- **Re-confirm that headgap adjusting lever be set ON position No. 1 before going item No. (h).**
- **Through all adjustments, ignore the position of limitter for fixing ribbon protector.**
- **For item (h), when shaking the ribbon protector right and left softly, it should be set at the position which both centre of the tip of printhead and centre of the window of ribbon protector should be alined on the straight line.**



(3) Confirmation for adjustment

After adjusting item No. 1 thru No. 3, you have to confirm the following gaps with film gauge.

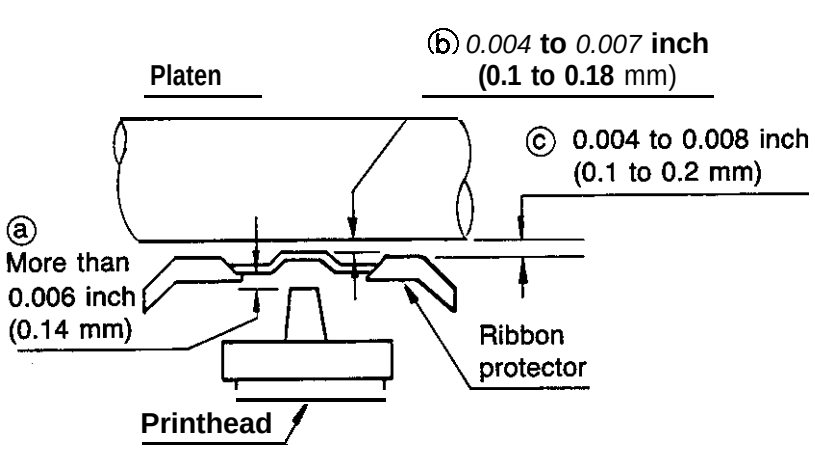
(a) The gaps to be confirmed

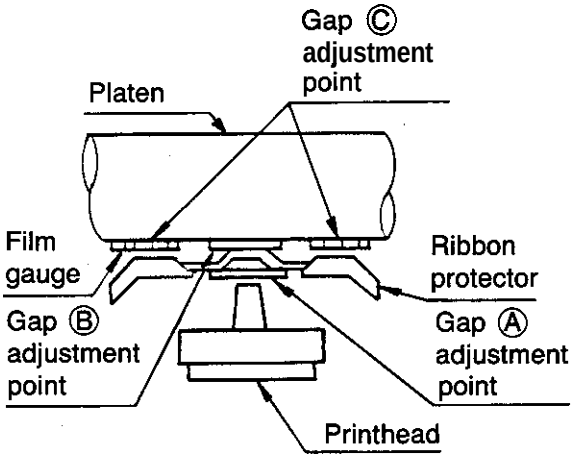
Gap A (between printhead and ribbon protector):
more than 0.006 inch (0.14 mm)
Gap B (between the centre of ribbon protector and platen):
0.004 to 0.007 inch (0.1 to 0.18 mm)
Gap C (between both sides of ribbon protector and platen):
0.004 to 0.008 inch (0.1 to 0.2 mm)

(b) Method of confirmation

Item	Gap	Number of films	Feeling when gauges inserted
Gap A	0.006 inch (0.15 mm)	3 stacks	Not feeling rough
Gap B	0.004 inch (0.1 mm)	2 stacks	Not feeling rough
	0.006 inch (0.15 mm)	3 stacks	Cannot insert
Gap C	0.004 inch (0.1 mm)	2 stacks	Not feeling rough
	0.008 inch (0.2 mm)	4 stacks	Cannot insert

Note: *The confirmation above should be done after setting the headgap adjusting lever at position No. 1.*





(4) Readjustment

In case that you cannot correctly make adjustment as described above due to inaccuracy of parts concerned, especially plastic parts, you may have to do the same changing number of films to be inserted between tip of print head and ribbon protector to 5 thru 8 stacks. (Referring to No. (2) item (f))

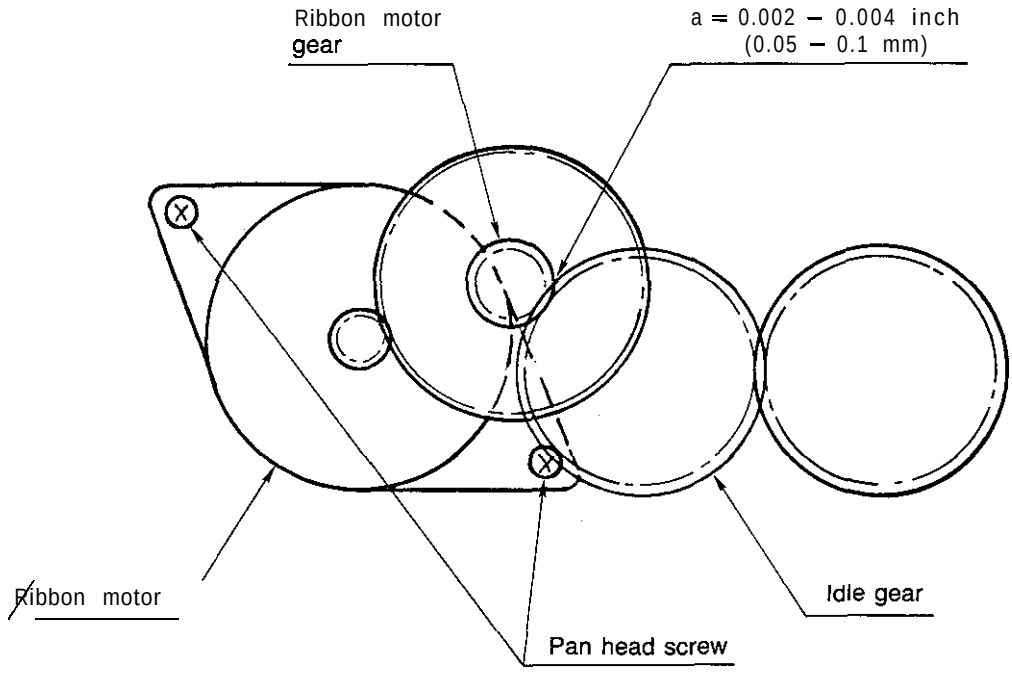
6.3 Ribbon Motor Gear Backlash

(1) Adjustment value

a = 0.002 to 0.004 inch (0.05 to 0.1 mm)

(2) Adjusting procedure

Loosen the two pan head screws securing the ribbon motor, and adjust the backlash between the ribbon motor gear and idle gear.



6.4 Ribbon Drive Bevel Gear Backlash

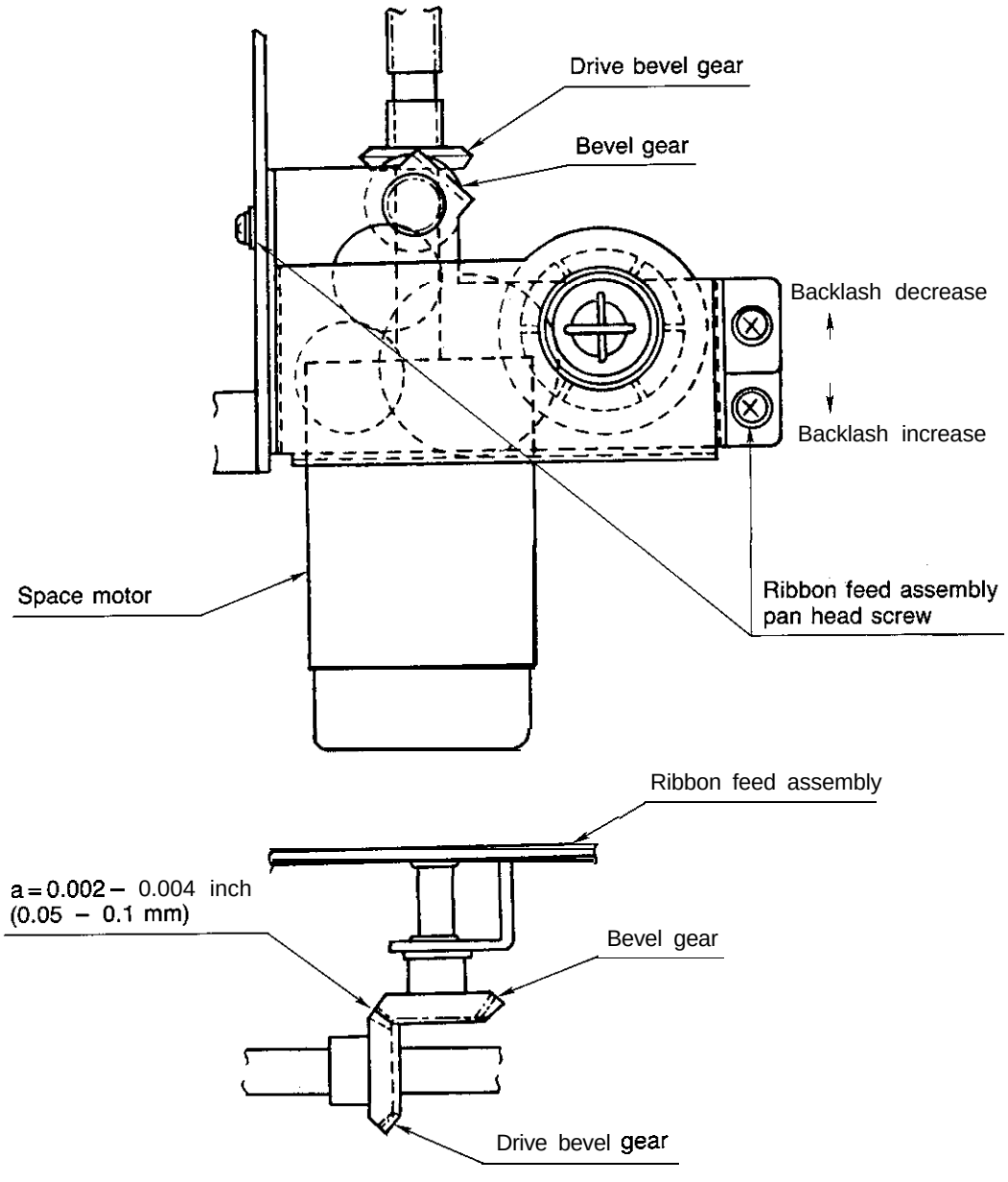
(1) **Adjustment value**

a = 0.002 to 0.004 inch (0.05 to 0.1 mm)

(2) **Adjusting procedure**

Loosen the two pan head screws securing the ribbon feed assembly, and move the ribbon feed assembly back and forth to adjust the gear backlash.

If moved forth, the backlash decreases.
If moved backward, the backlash increases.



6.5 Line Feed Belt Tension

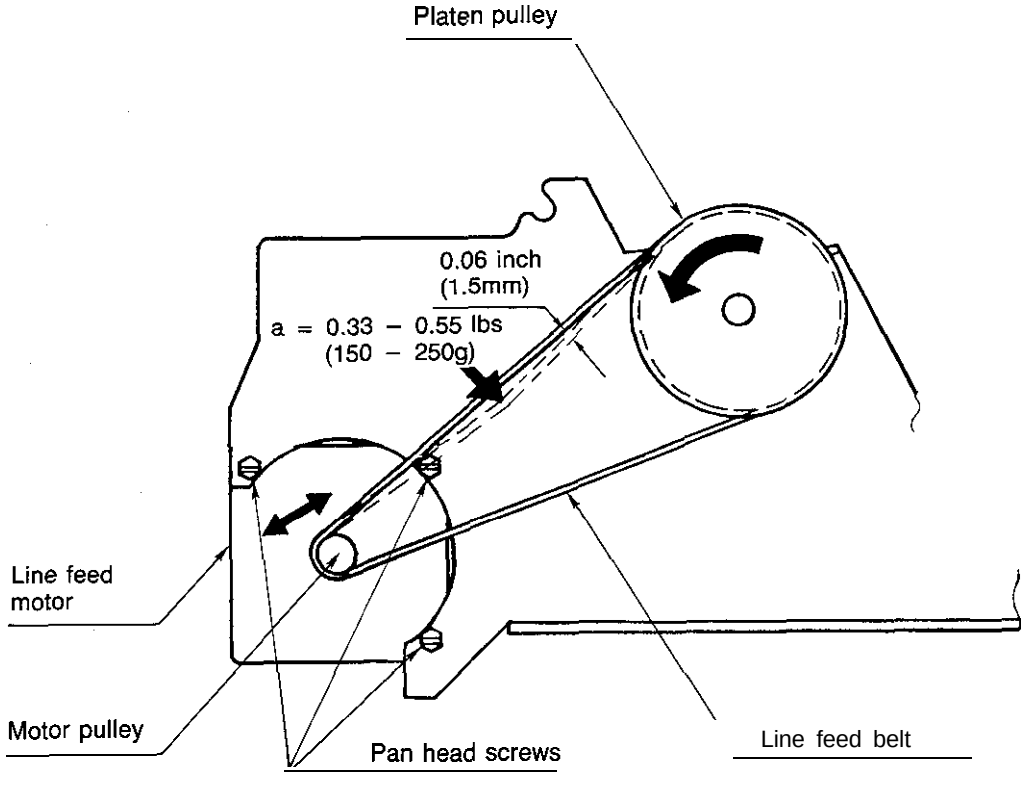
(1) Adjustment value

a = 0.33 to 0.55 lbs (150 to 250 g)

(2) Adjusting procedure

Adjust the line feed motor position so that the specified belt tension is obtained when the belt is depressed 0.06 inch (1.5 mm) in the middle of the span between the platen pulley and motor pulley.

Note: Revolve the platen *pulley at least once before adjustment.*



6.6 Adjustment with Color Model

Adjust the ribbon guide height and the gap between the shift cam lever and the color shift sensor by the procedure in the following:

(1) Position for adjustment

Perform adjustment for the left end, the center and the right end of the carriage assembly.

(2) Adjustment value

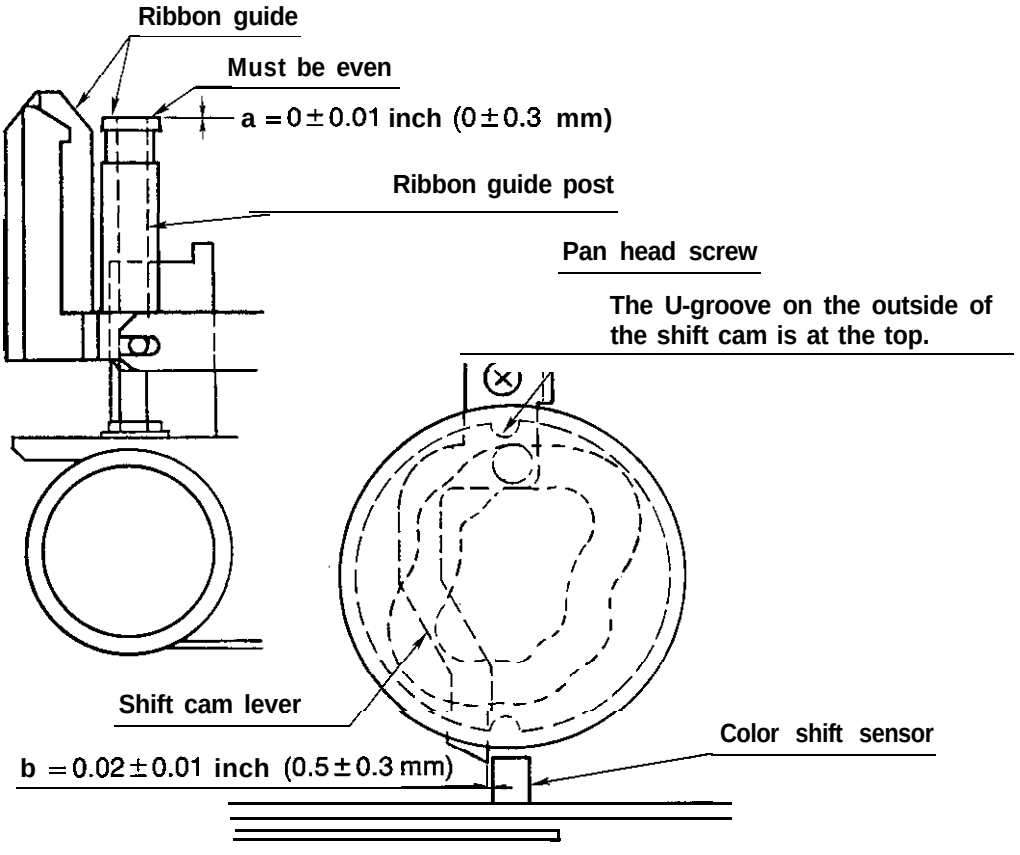
a = 0 ± 0.01 inch (0 ± 0.3 mm)
b = 0.02 ± 0.01 inch (0.5 ± 0.3 mm)

(3) Adjustment procedure

When the U-groove on the outside of the shift cam is at the top;

1. **The top of the ribbon guide post must be even with the top of the ribbon guide.**
2. **The gap between the color shift sensor end face and the shift cam lever must be within 0.02 ± 0.01 inch (0.5 ± 0.3 mm).**

Loosen the pan head screw to perform these adjustments.


Ribbon guide
Must be even
a = 0 ± 0.01 inch (0 ± 0.3 mm)
Ribbon guide post
Pan head screw
The U-groove on the outside of the shift cam is at the top.
Shift cam lever
Color shift sensor
b = 0.02 ± 0.01 inch (0.5 ± 0.3 mm)

7. TROUBLESHOOTING PROCEDURES

7. TROUBLESHOOTING PROCEDURES

7.1 Cautions Before Starting Repair Work

(1) **Check the inspection items specified in the instruction manual.**

(2) **Find out as many details of the trouble as possible from the customer.**

(3) **Inspect in the conditions as close as possible to those at the time the trouble occurred.**

(4) **Proceed with the repair as follows:**

Check the trouble status according to Table 7.1 for the details of the trouble. Then, locate the trouble position according to the detailed flowchart.

(5) **Read the cautions given in Section 7.1 before starting the repair work.**

(6) **Carry out a thorough test after the repair to check for correct functioning.**

7.2 Troubleshooting Table

Table 7.1

Status	Details	Flowchart item No.
Trouble upon power on	• **Power is not supplied.**	①
	• **No spacing operation.** (Alarm lamp blinking)	②
	• **Homing does not end normally.**	③
Trouble during printing	• **Wrong character, character omission or dot omission**	④
	• **Ribbon feed trouble**	⑤
	• **Line feed trouble**	⑥
	• **Malfunction of switch on operation panel**	⑦
	• **Data receiving failure**	⑧
	• **Trouble with change of color ribbon (color model)**	⑨

7.3 lamp Display

(1) Printer mode display

Table 7.2

Printer mode		ALARM	SELECT	Contents	Remarks
Operation mode	ON LINE	OFF	ON	Indicates that the printer is ready for receiving.	
	HEX DUMP			Indicates that the printer is in the hexa dump mode.	
	LOCAL	OFF	OFF	Indicates that the printer is in the local mode.	
	MENU			Indicates that the printer is in the menu mode.	
	MACRO			Indicates that the printer is in the macro mode.	QUIET lamp blinking
operator alarm	Paper end	ON	OFF	Form end, single sheet end, or bottom paper end	
	Paper jam			SASF paper jam or double paper setting	
	CSF paper jam			Paper jam or paper end when CSF is installed	
	Cover open	ON	OFF	Indicates that the cover is open.	
	Print suppress	OFF	BLINK	Indicates that the printer is in the print suppress mode.	
Fault alarm		BLINK	ON	For details see paragraph (2) fault alarm display.	

(2) Fault alarm display

When the printer detects any of the various alarm states, the information is displayed as shown below on the operation panel. The alarm No. is displayed by lamps ❑ and ❑ . (See Table 7.3 for details.)

Example: For alarm No. 53

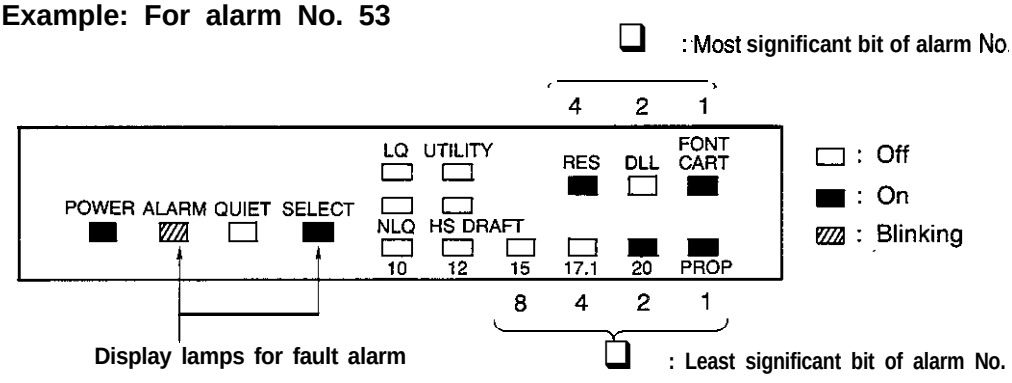

❑ : Most significant bit of alarm No.
4 2 1
LQ UTILITY
RES DLL FONT CART
POWER ALARM QUIET SELECT
NLQ HS DRAFT
10 12 15 17.1 20 PROP
8 4 2 1
❑ : Least significant bit of alarm No.
Display lamps for fault alarm
□ : Off
■ : On
▨ : Blinking

Figure 7-1

Table 7.3

Error category	Alarm No. (Hex.)	contents
MPU ROM/RAM check error	11	MPU internal RAM error
	12	Program ROM error
	13	Resident CG error
Slave MPU ROM/RAM check error	21	Slave ROM/RAM error
	22	Slave/Master matching error
External RAM error	31	External RAM error
Master MPU error	41	Command Fifo check error
	43	Print pass error
	44	Position sense error
Slave MPU error	51	Print over run error
	52	Print stop error
	53	Head homing error
	56	EEPROM write error
	57	Spacing error
	5B	Ribbon error
	5c	Bail arm error
Mechanical error	60	Fan alarm

7.4 Parts Layout

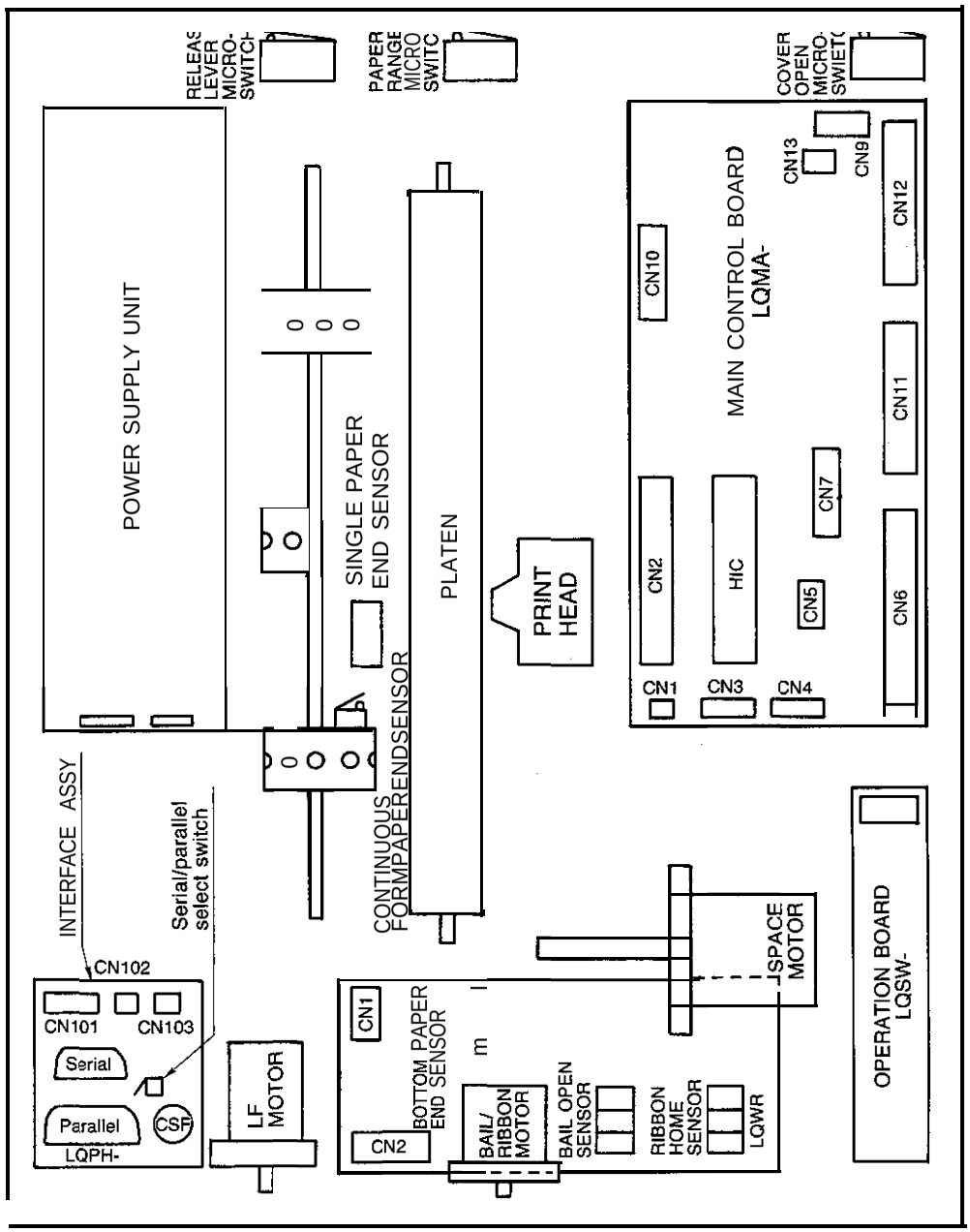
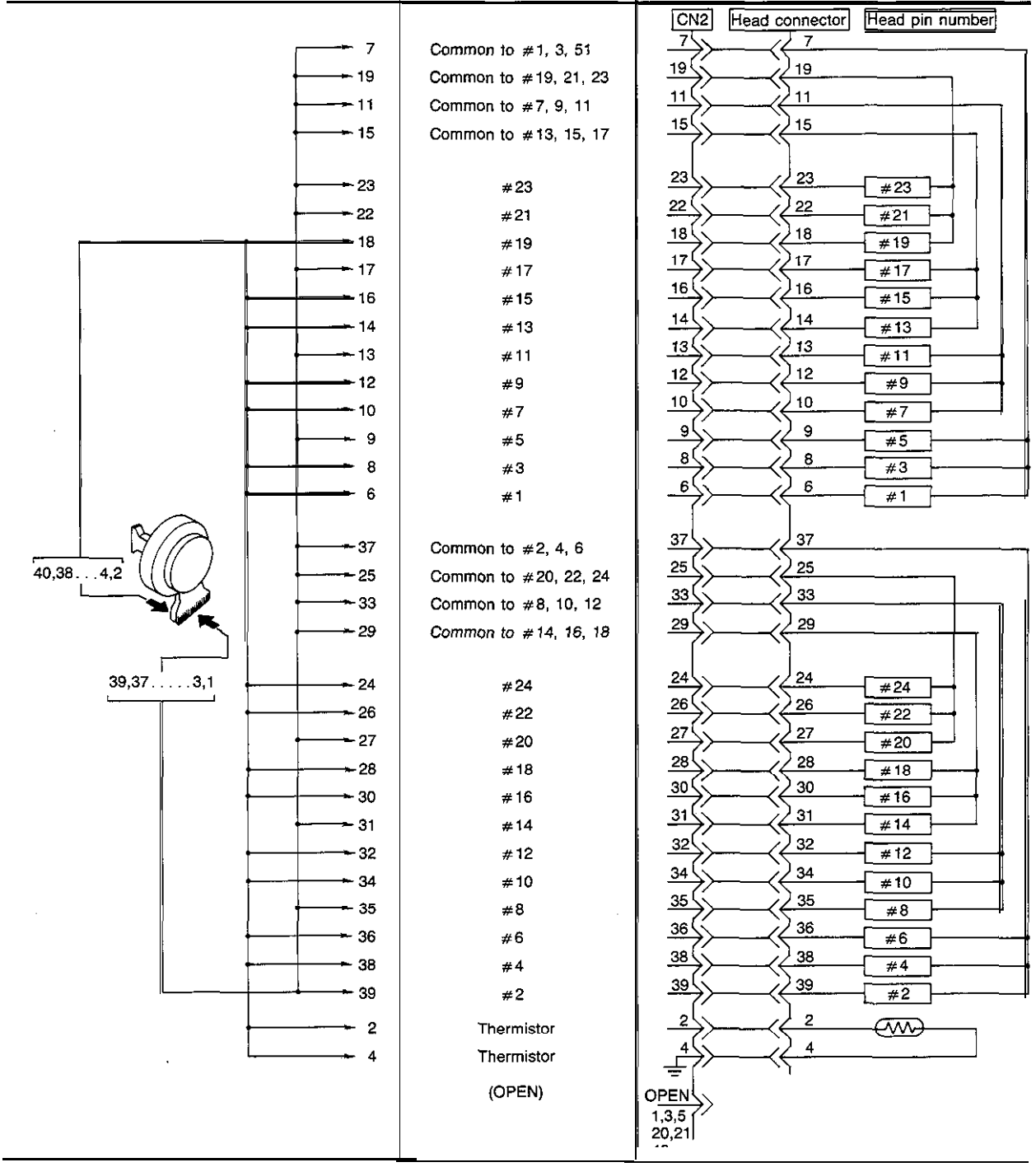


Figure 7-2

7.5 Connection Circuit and Resistance Check for Printhead and LF/SP/RBN Motor

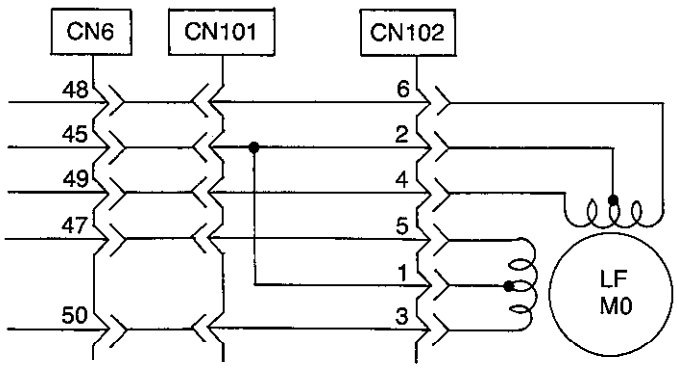
(1) Printhead

Resistance of each coil should be about 4.5Ω



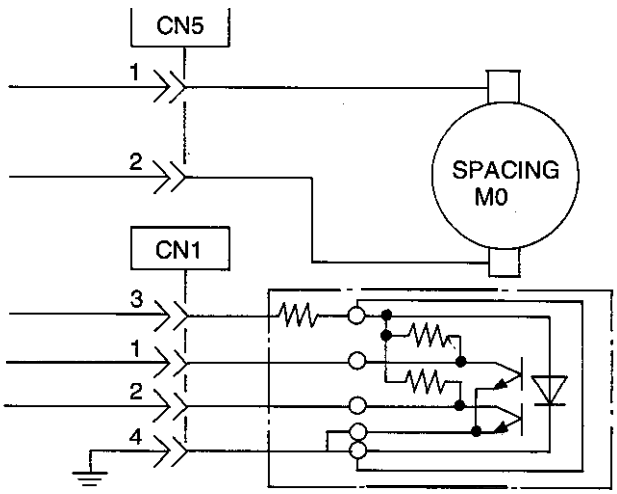
(2) line feed motor

Resistance of each coil should be about 8.5Ω

Pin number of LF motor	Signal	Connector pin number
6	LFϕ1DV	
2	LFCOM	
4	LFϕ3DV	
5	LFϕ2DV	
1	(LFCOM)	
3	LFϕ4DV	

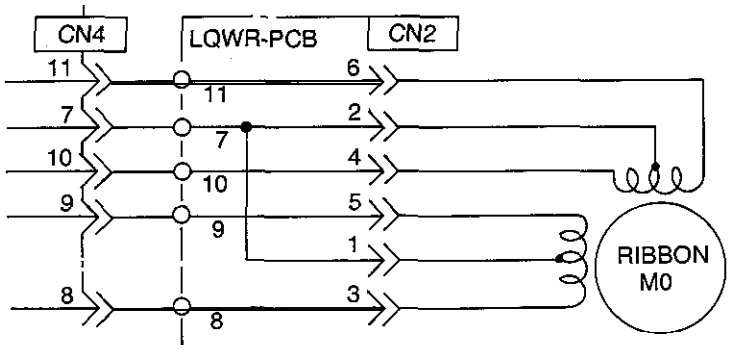
(3) Space motor

Resistance of motor should be about 11.4Ω

Pin number of SP motor	Signal	Connector pin number
1	SPM 1	
2	SPM2	
3	+5V	
1	SPϕA	
2	SPϕB	
4	FG	

(4) Ribbon motor

Resistance of each coil should be about 34Ω

Pin number of Ribbon motor	Signal	Connector pin number
6	RBNϕ1DV	
2	RBNCOM	
4	RBNϕ3DV	
5	RBNϕ2DV	
1	(RBNCOM)	
3	RBNϕ4DV	

7.6 Troubleshooting Flow Chart

① **Power is not supplied.**

- **Is the AC cable connected correctly?**

YES NO

- **Connect the AC cable correctly.**

- **Is fuse F1 on the power supply unit blown?**

NO YES

- **Replace fuse F1.**
- **Remedied?**

NO YES

- **End**
- **Replace the power supply unit or connection cable. (See Section 5.2.19.)**

- **Are the +5 V and +38 V outputs in the control board provided?**
  +38V: Check on the both ends of the capacitor Cl.
  +5V: Check between the pin 40 of Q11 and the power bar. (See figure below.)

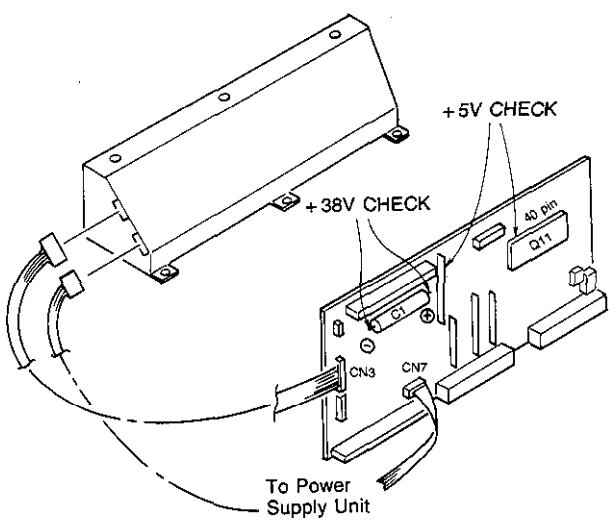
YES NO

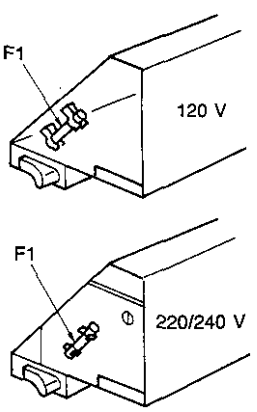
- **Are cables CN3 and CN7 on the control board connected correctly?**

NO YES

- **Replace the power supply unit or connection cable. (See Section 52.19.)**
- **Connect them correctly.**

- **Replace the control board. (See Section 5.2.7.)**





② No space operation (The alarm lamp blinks.)

- Is carriage assembly binding or Jammed?

NO YES

- Check around the carriage assembly and the space motor to repair the mechanism.

- Replace the personality cartridge.
- Remedied?

NO • YES

- End

- Is fuse F1 on the control board blown?

NO YES

- Replace fuse F1.
- Remedied?

NO YES

- End
- To step@

Ⓐ • Is the +38 V output on the control board provided? (Check on the both ends of the capacitor Cl.)

YES NO

- Are cables CN3 and CN7 on the control board connected correctly?

YES NO

- Connect them correctly.
- Replace the power supply unit or connection cable. (See Section 5.2.19.)

- Are cables CN1 and CN5 on the control board connected correctly?

YES NO

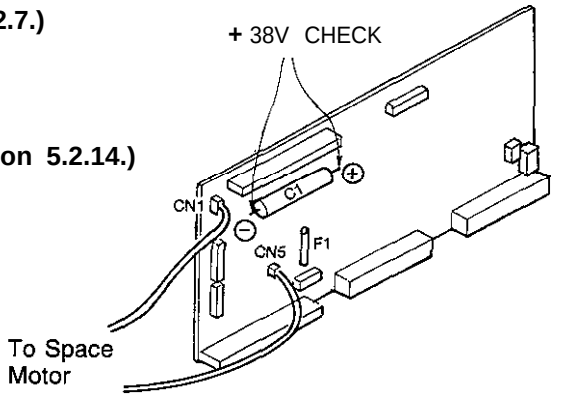
- Connect them correctly.

- Replace the control board. (See Section 5.2.7.)
- Remedied?

YES NO

- Replace the space motor. (See section 5.2.14.)

- End



③ Homing does not end normally.

- Alarm 5B (ribbon homing error)?

NO YES

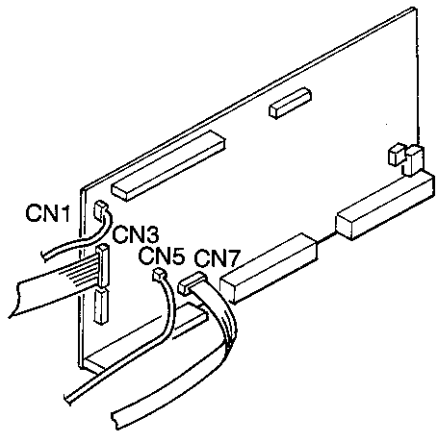
- To step 3-2

- Alarm 5C (bail alarm error)?

NO YES

- To step 3-4

- Alarm 60 (fan alarm error)?



NO YES

- Replace the power supply unit. (See Section 5.2.19.)

- Alarm 53 (head homing error)?

NO YES

- Is the +38 V output on the control board proper?

YES NO

- Are the cables of CN3 and CN7 on the control board correctly connected to the power supply unit?

NO YES

- Replace the power supply unit. (See Section 5.2.19.)
- Connect them correctly.

- Is cable CN1 on the control board connected correctly?

YES NO

- Connect it correctly.

Ⓐ
- Replace the control board. (See Section 5.2.7.)
- Remedied?

NO YES

- End

- Replace the space motor. (See Section 5.2.14.)

3-1

3-1

- Turn off the power and manually move the carriage. Does it move smoothly?

NO YES

- To step Ⓐ

- Are there any paper scraps or dirt on the spacing mechanism?

NO YES

- Remove it.

- Remove the ribbon cartridge.
- Does the carriage move smoothly?

NO YES

- Replace the ribbon cartridge.

- Replace the ribbon feed assembly. (See Section 5.2.13.)

3-2

• Is the printer the color model?

YES NO

• Is the short plug on the control board open (single-color setting)?

YES NO

• Set the short plug to open (single-color setting).
• To Step Ⓑ

Setting of short plug SP1

use	Setting
Use of the control board for single color machine	Open
Use of the control board for color model	Short

• Manually rotate the ribbon shift cam counterclockwise.
• Does it rotate smoothly?

YES NO

• Check the following points.
  - No paper scraps or foreign matter on the gear portion.
  - Smooth gear meshing
  - No friction at each fulcrum of the cartridge bracket, roller lever and ribbon shift arm

• Is cable CN2 on the sensor board connected correctly?

YES NO

• Connect it correctly.

• Is cable CN4 on the control board connected correctly?

YES NO

• Connect it correctly.

• Is there dirt or dust on the ribbon home sensor on the sensor board?

NO YES

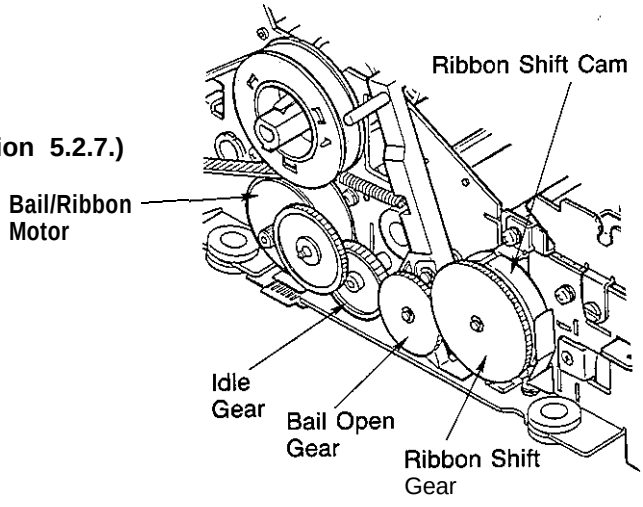
• Clean the sensor.

Ⓑ • Replace the control board. (See Section 5.2.7.)
• Remedied?

YES NO

• To Step 3-3

• End



3-3

- **Replace the bail/ribbon motor. (See Section 5.2.16.)**
- **Remedied?**

YES NO

- **Replace the sensor board. (See Section 5.2.12.)**

- **End**

3-4

- Manually rotate the bail open gear counterclockwise.
- Does it rotate smoothly?

YES NO

- No paper scrap or foreign matter near the bail/ribbon motor gear, idle gear and bail open gear
- Check the meshing of each of the above gears.

- Is cable CN4 on the control board connected correctly?

YES NO

- Connect it correctly

- Is cable CN2 on the sensor board connected correctly.?

YES NO

- Connect it correctly.

- Is there dirt or dust on the sensor on the sensor board?

NO YES

- Clean the sensor.

- Is bail arm L damaged?

NO YES

- Replace bail arm L.

- Replace the control board. (See Section 5.2.7.)
- Remedied?

YES NO

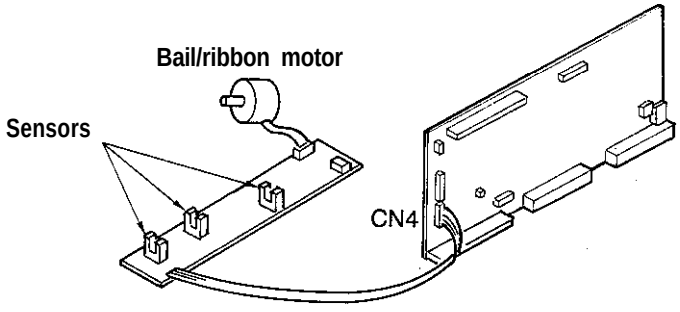
- Replace the sensor board. (See Section 5.2.12.)
- Remedied?

YES NO

- Replace the bail/ribbon motor. (See Section 52.16.)

End

- End



④ Wrong character, character omission or dot omission

- Are cables CN2 and CN6 on the control board connected correctly?

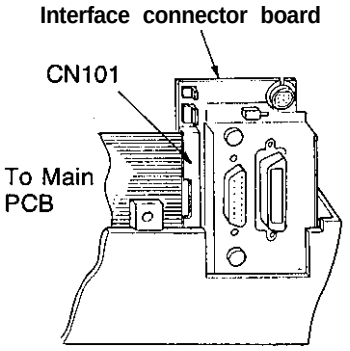
YES NO

- Connect them correctly.

- Is cable CN101 on the interface connector board connected correctly?

YES NO

- Connect it correctly.



- Is the interface cable connected correctly?

YES NO

- Connect it correctly.

- Are ±8V outputs on the control board provided?

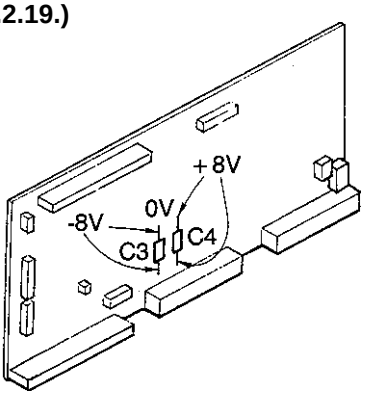
YES NO

- Are cables CN3 and CN7 on the control board connected correctly to the power supply unit?

YES NO

- Connect them correctly.
- Replace the power supply unit. (See Section 5.2.19.)

- Replace the print head. (See Section 5.2.1.)
- Remedied?



YES NO

- Replace the personality cartridge.
- Remedied?

NO YES

. End

- Replace the control board. (See Section 5.2.7.)
- Remedied?

NO YES

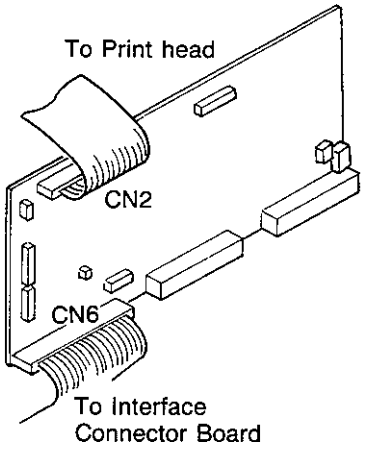
- End

- Do cables connected to CN2 and CN6 on the control board have interval open-circuit?

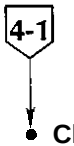
NO YES

- Replace the cable(s).

- To Step 4-1



. End



- **Check the menu settings related to the interface.**
  - **Baud rate**
  - **Character format**
  - **Protocol**
  - **Busy signal output terminal selection**

⑤ Ribbon feed trouble

- Remove the ribbon cartridge and rotate the ribbon cartridge ribbon feed knob.
- Does it rotate smoothly?

YES

NO

- Check to see if ribbon lock mechanism has been disengaged.
- Replace the ribbon cartridge.

- Manually shift the carriage to the left and to the right.
- Does the ribbon feed shaft rotate?

YES

NO

- Replace the ribbon feed assembly (See Section 5.2.13.)
  . After the replacement, it is necessary to adjust the backlash between the space motor gear and bevel gear. (See Section 6.4.)

- Check that the ribbon feed shaft is correctly engaged with the ribbon feed roller of the ribbon cartridge.

⑥ Line feed trouble

- Manually rotate the platen knob.
- Does it rotate smoothly?

YES NO

- Set the release lever to the open side.
- Does the platen knob rotate smoothly?

NO YES

- Correct paper setting.
- No foreign matter or dust on the platen gear, idle gear or drive gear
- Smooth meshing of platen gear, idle gear and drive gear
- Correct phasing of push tractor assembly (R) or (L) (See Section 5.2.18.)
- Replacement of push tractor assembly (R) or (L). (See Section 5.2.18.)
- Adjust the LF motor mini pitch belt tension. (See Section 6.5)

- Is cable CN6 on the control board connected correctly?

YES NO

- Connect it correctly.

- Is cable CN101 on the interface connector board connected correctly?

YES NO

- Connect it correctly.

- Is cable CN102 on the interface connector board connected correctly?

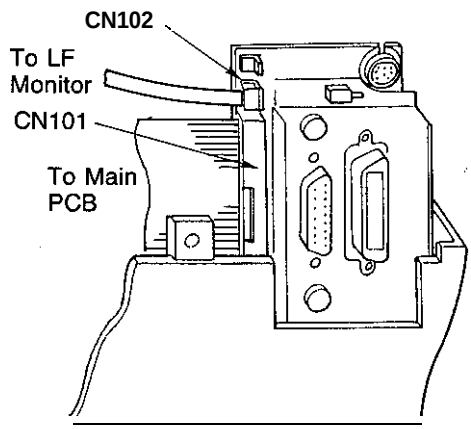
YES NO

- Connect it correctly.

- Replace the control board. (See Section 5.2.7.)
- Remedied?

YES NO

- Replace the LF motor.
  (See Section 5.2.10.)
  After the LF motor replacement,
  belt tension adjustment is necessary.
  (See Section 6.5.)



- End

⑦ Malfunction of switch on operation board

- Is cable CN1 on the operation board connected correctly?

YES NO

- Connect it correctly.

- Is cable CN10 on the control board connected correctly?

YES NO

- Connect it correctly.

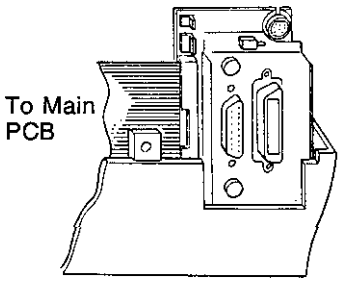
- Replace the operation board. (See Section 5.2.5.)
- Remedied?

YES NO

- Replace the control board. (See Section 5.2.7.)

- End

⑧ Data receiving failure



- Is select lamp blinking?

NO YES

- Set menu to ignore DC3.

- Is the alarm lamp on?

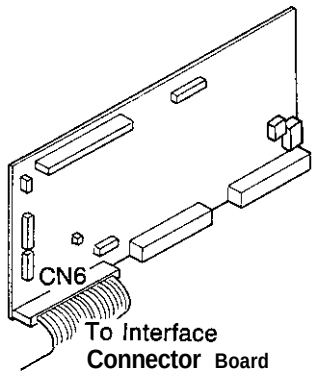
NO YES

- To Step 8-1

- Is the SELECT lamp on?

YES NO

- Set to the SELECT mode.



- Is the interface cable connected correctly?

YES NO

- Connect it correctly.

- Is cable CN101 on the interface connector board connected correctly?

YES NO

- Connect it correctly.

- Is cable CN6 on the operation board connected correctly?

YES NO

- Connect it correctly.

- Branch the search path depending on whether the interface is parallel or serial.

Parallel interface

Serial interface

- Correctly set the interface menu parameters.
  - Baud rate
  - Character format
  - Protocol
  - Busy signal polarity

- Remedied?

NO YES

. End

- Are ±8 V outputs provided on the control board?

YES NO

- Replace the power supply unit. (See Section 5.2.19.)

- To Step Ⓐ

Ⓐ • Replace the personality cartridge,
• Remedied?

YES

NO

• Replace the control board. (See Section 5.2.7.)
• Remedied?

YES

NO

• Replace the interface connector board. (See Section 5.2.6.)
Check shorting plugs.
• Replace the cable connected to CN6 on the control board.

• End

• End

8-1

- Remove the upper cover (See section 5.2.4.), and turn on the power with one hand while pressing the cover open microswitch with the other hand.
- Does the alarm lamp come on?

YES NO

- Correctly connect cable CN13 on the control board.
- Check the correspondence between the front access cover and cover open lever.
- Replace the cover open microswitch cable assembly.

- Is the paper set?

YES NO

- Set the paper.

- Does the continuous form end microswitch function correctly?

YES NO

- Correctly connect CN103 on the interface connector board.
- Replace the sheet feeder assembly (L). (See Section 5.2.18.)

- Does the single sheet end sensor function correctly?

YES NO

- Check that there is no dirt or dust on the sensor surface.
- Correctly connect CN1 on the sensor board.
- Replace the sensor cable assembly.

- Does the bottom paper end sensor function correctly?

YES NO

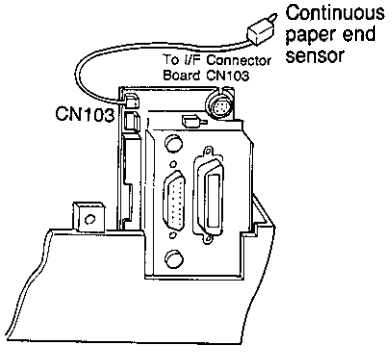
- Check that there is no dirt or dust on the sensor board.
- Correctly connect cable CN4 on the control board.
- Replace the sensor board. (See Section 5.212.)

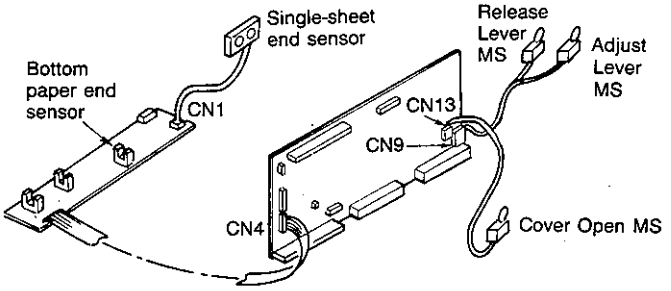
- Does the release lever microswitch function correctly?

YES NO

- Correctly connect cable CN9 on the control board.
- Replace the release lever, microswitch and cable assembly.

- Replace the control board. (See Section 5.2.7.)





(9) Color ribbon change trouble

- No change operation?

YES / NO

- To Step 9-1

- Is black ribbon set on the menu?

NO / YES

- Set another color.
- Remedied?

NO / YES

- End

- To Step (A)

(A) - Are CN4 on the control board and CN2 on the sensor board connected correctly?

YES / NO

- Connect the cables correctly.
- Remedied?

NO / /YES/

. End

- To Step 9-2

9-2

- Replace the control board. (See Section 5.2.7.)
- Remedied?

YES / NO

- Replace the ribbon/bail motor assembly. (See Section 5.2.16.)

. End

9-1

• Is the ribbon route normal?

YES NO

• Correct to the normal route.
• Remedied?

NO YES

• End
• To Step Ⓑ

Ⓑ • Check the following parts:
. Shoulder screw
. Roller lever
. Ribbon shift arm and spring
. Ribbon cartridge balance spring

• Are they normal?

YES NO

• Correct the installation or replace.
• Remedied?

NO YES

• End
• To Step Ⓒ

Ⓒ • Check the following parts:
• Ribbon shift cam and gear
. Ribbon shift cam/lever assembly

YES NO

• Correct the installation or replace.
• Remedied?

NO YES

• End
• To Step Ⓓ

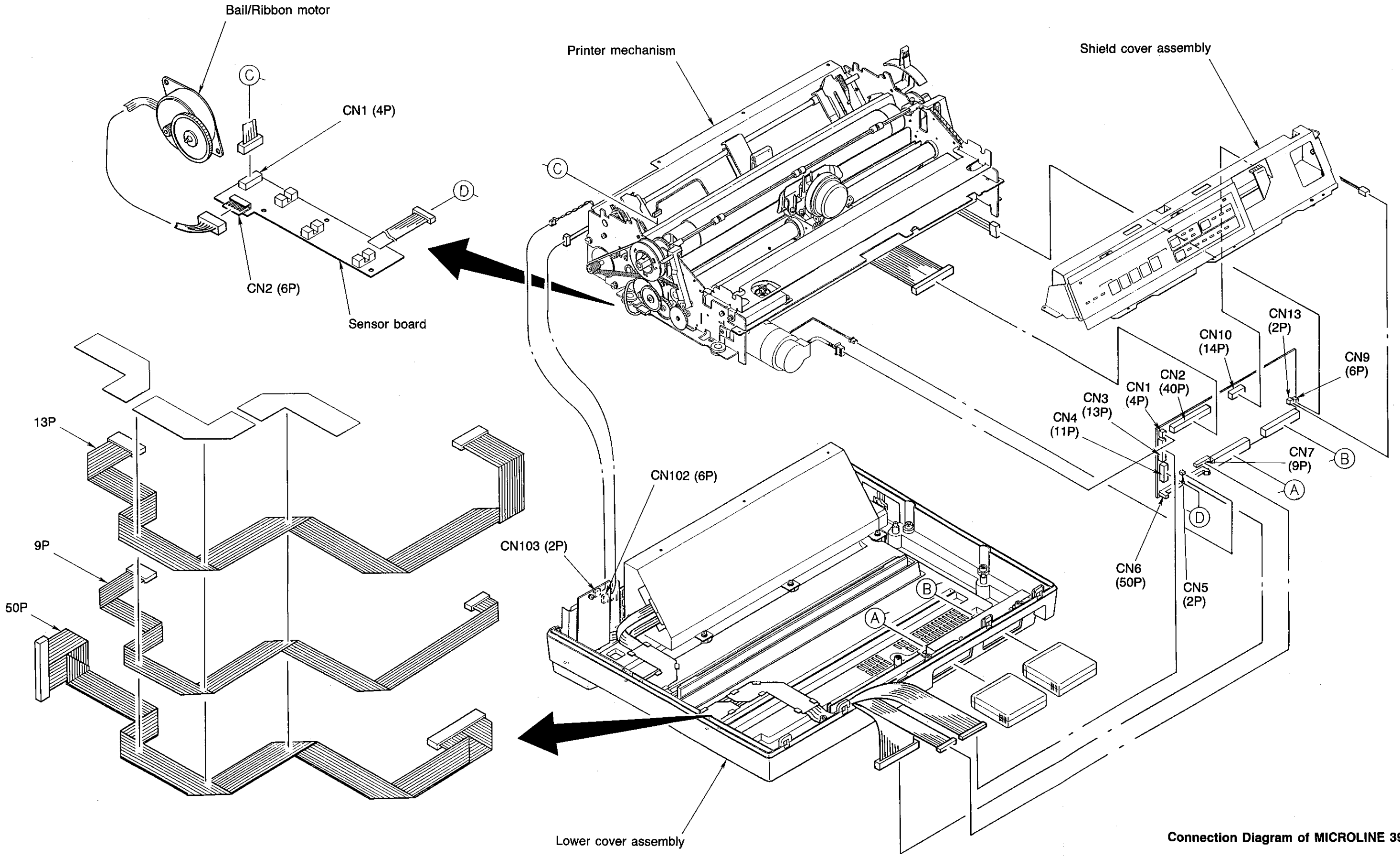
Ⓓ • Replace the sensor board. (See Section 5.2.12.)
• Remedied?

YES NO

• To Step 9-2

• End

8. CONNECTION DIAGRAM



Connection Diagram of MICROLINE 393

9. CIRCUIT DIAGRAM

9. CIRCUIT DIAGRAM

9.1 Signal List

Abbreviation of signal name	Signal name	Function
0V	Signal Ground	Ground for logical circuit.
38VF	38 Volt	Power supply for driver circuit.
A8-A15	MASTER CPU ADDRESS BUS	Address bus signal of master CPU (80C154)
AD0-AD7	MASTER CPU ADDRESS/ DATA BUS	Address/data bus signal of master CPU (80C154)
$\overline{\text{ACK}}$	ACKNOWLEDGE	Centronics interface signal indicating that data reception is ready.
ALE	ADDRESS LATCH ENABLE	Causes the low order address of master CPU (80C154) to be latched to the address latch.
$\overline{\text{AUTO FEED EX}}$	AUTOMATIC PAPER FEED EXECUTE	Centronics interface signal indicating automatic line feed when CR code is received for low level.
$\overline{\text{AUTO FEED EX/DSR}}$	AUTOMATIC PAPER FEED EXECUTE or DATA SET READY	The signal indicating $\overline{\text{AUTO FEED EX}}$ when centronics interface is selected and DATA SET READY when RS232C is selected.
BELL	BELL	Buzzer ringing signal.
BOTTOM END	BOTTOM PATH PAPER END	Bottom path paper end.
BUSY	BUSY	Centronics interface signal indicating that data is under processing.
CD	CARRIER DETECT	RS 232C interface signal indicates under sending for high level.
$\overline{\text{CENTRO SELECT}}$	CENTRONIX INTERFACE SELECT	Indicates that the centronics interface is being selected.
$\overline{\text{CG1CS-CG3CS}}$	CHARACTER GENERATOR #n CHIP SELECT	The signal to select character generators (No. 1 to No. 3).
CGA13-CGA15	CHARACTER GENERATOR ADDRESS	Address signal of character generator.
$\overline{\text{CHR PITCH SW}}$	CHARACTER PITCH SWITCH	Character pitch switch press signal.
CMND	COMMAND	The signal indicating that the data from master CPU to slave CPU is the operation command data.
CONT PPR END	CONTINUOUS PAPER END	Continuous paper end.
$\overline{\text{COV OPEN}}$	COVER OPEN	Access cover open signal.
$\overline{\text{CSF COMMAND1}}$	CUT-SHEET FEEDER COMMAND1	CSF interface signal, Operation command signal 1.

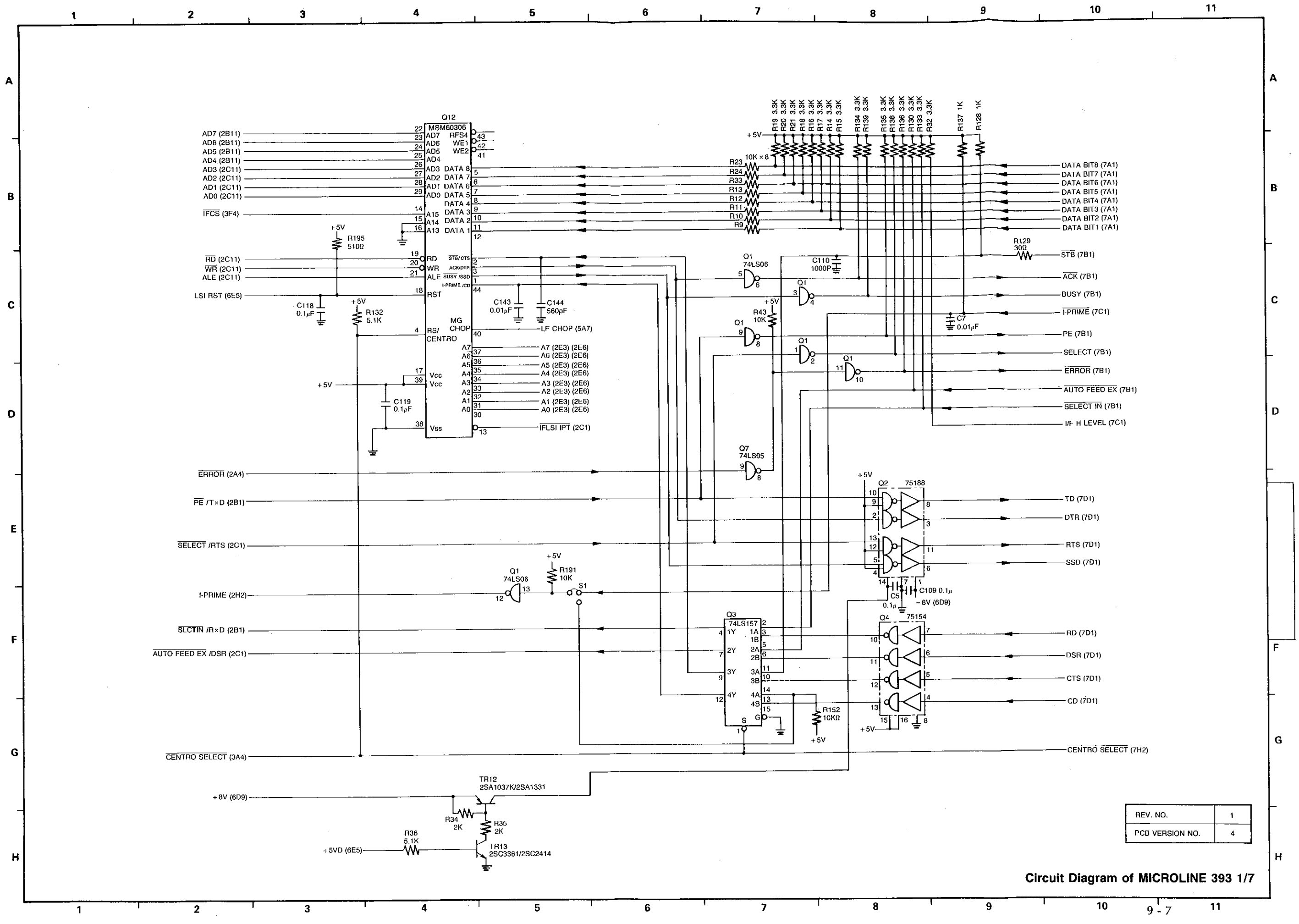
Abbreviation of signal name	Signal name	Function
$\overline{\text{CSF COMMAND2}}$	CUT-SHEET FEEDER COMMAND2	CSF interface signal, Operation command signal 2.
$\overline{\text{CSF CONNECT}}$	CUT-SHEET FEEDER CONNECT	CSF interface signal that goes low level when CSF is connected.
$\overline{\text{CSF PE}}$	CUT-SHEET FEEDER	CSF interface signal indicating that CSF hopper paper end.
CTS	CLEAR TO SEND	RS232C interface signal indicating that the printer is ready for reception.
CUT PPR END	CUT-SHEET PAPER END	Cut-sheet paper end.
D1-D24	HEAD DATA n	Head pin driving signal.
DATA BIT1-DATA BIT8	RECEIVE DATA	Receive data.
DSR	DATA SET READY	RS232C interface signal indicating that the host side is ready for data sending.
EDVC	EVEN PIN DRIVE FOR CENTER	Even pin driving signal (for center pin).
EDVS	EVEN PIN DRIVE FOR EDGE	Even pin driving signal (for end pin).
EEPROM DI	EEPROM DATA IN (Electric Erasable Programable ROM)	Write signal line into EEPROM.
EEPROM CS	EEPROM CHIP SELECT	EEPROM selection signal.
EEPROM CLK	EEPROM CLOCK	EEPROM input data storing signal.
EEPROM DO	EEPROM DATA OUT	Data read-out line from EEPROM.
EP	POWER GROUND	Ground of driving circuit system.
$\overline{\text{ERROR}}$	ERROR	Centronics interface signal indicating that the printer is in error state.
EVEN #2, #4, #6 COM	EVEN PIN COMMON	Even pin common driving signal.
EVEN #8, #10, #12 COM	EVEN PIN COMMON	The same as above.
EVEN #14, #16, #18 COM	EVEN PIN COMMON	The same as above.
EVEN #20, #22, #24 COM	EVEN PIN COMMON	The same as above.
EVEN #2DV- EVEN #24DV	EVEN PIN DRIVE	Even pin driving command.
$\overline{\text{FAN OFF}}$	FAN OFF	The signal to cause the fan to be turned off when cooling by fan is not necessary.
FAN OFF POW	FAN OFF TO POWER SUPPLY	The signal to cause the fan to be turned off when cooling by fan is not necessary.
$\overline{\text{FF SW}}$	FORM FEED SWITCH	Form feed switch press signal.
FG	FRAME GROUND	Ground for maintenance.
$\overline{\text{FONT SEL SW}}$	FONT SELECT SWITCH	Turn on the front select switch.

Abbreviation of signal name	Signal name	Function
HD E ALM	HEAD DRIVE ALARM for EVEN	Head driver circuit is abnormal (even pin).
HD O ALM	HEAD DRIVER ALARM for ODD	Head driver circuit is abnormal (odd pin).
$\overline{\text{HEAD ALM}}$	HEAD THERMAL ALARM	The signal indicating that the head temperature is extra-ordinarily high.
HEAD GAP	HEAD GAP	The signal to distinguish the thin paper from the cardboard.
HEAD TEMP	HEAD TEMPERATURE	Temperature sensor output in the head.
HEAD VOLTAGE	HEAD VOLTAGE	The signal indicating that the head driving power is less than the specified value.
$\overline{\text{IF CS}}$	INTERFACE LSI CHIP SELECT	LSI select signal for interface.
I/F H LEVEL	INTERFACE HIGH LEVEL	Centronics interface signal. Power supply line for external units.
$\overline{\text{IF LSI IPT}}$	INTERFACE LSI INTERRUPT	The signal line to interrupt CPU when an interface receives data by one byte.
I-PRIME	INPUT PRIME	Centronics interface signal indicating the command for printer initialization.
$\overline{\text{I-PRIME}}$	INPUT PRIME	Command for printer initialization.
LF ALM	LINE FEED DRIVER ALARM	Abnormal signal for line-feed motor driver circuit.
$\overline{\text{LF CHOP}}$	LINE FEED MOTOR CHOPPING	Control signal for line-feed motor current suppression.
LF COM	LINE FEED MOTOR COMMON	Line-feed motor common line.
$\overline{\text{LF OVDV}}$	LINE FEED MOTOR OVER DRIVE	Line feed motor high voltage apply command.
$\overline{\text{LF SW}}$	LINE FEED SWITCH	Line feed switch press signal.
$\overline{\text{LF}\phi\text{1-LF}\phi\text{4}}$	LINE FEED DRIVER PHASE n DRIVE	Line feed motor phase existing command.
LFϕ1 DV-LFϕ4 DV	LINE FEED MOTOR PHASE n DRIVE	Line feed motor phase current line.
LSI RST	LSI RESET	Each LSI initialization.
$\overline{\text{MMU IPT}}$	MMU INTERRUPT (Memory Management Unit LSI)	Interrupt signal line from MMU.
$\overline{\text{MO LSI IPT}}$	MOTOR LSI INTERRUPT	Interrupt signal line from motor LSI.
ODD #1, #3, #5 COM	ODD PIN COMMON	Common driving signal of odd pin.
ODD #7, #9, #11 COM	ODD PIN COMMON	The same as above.

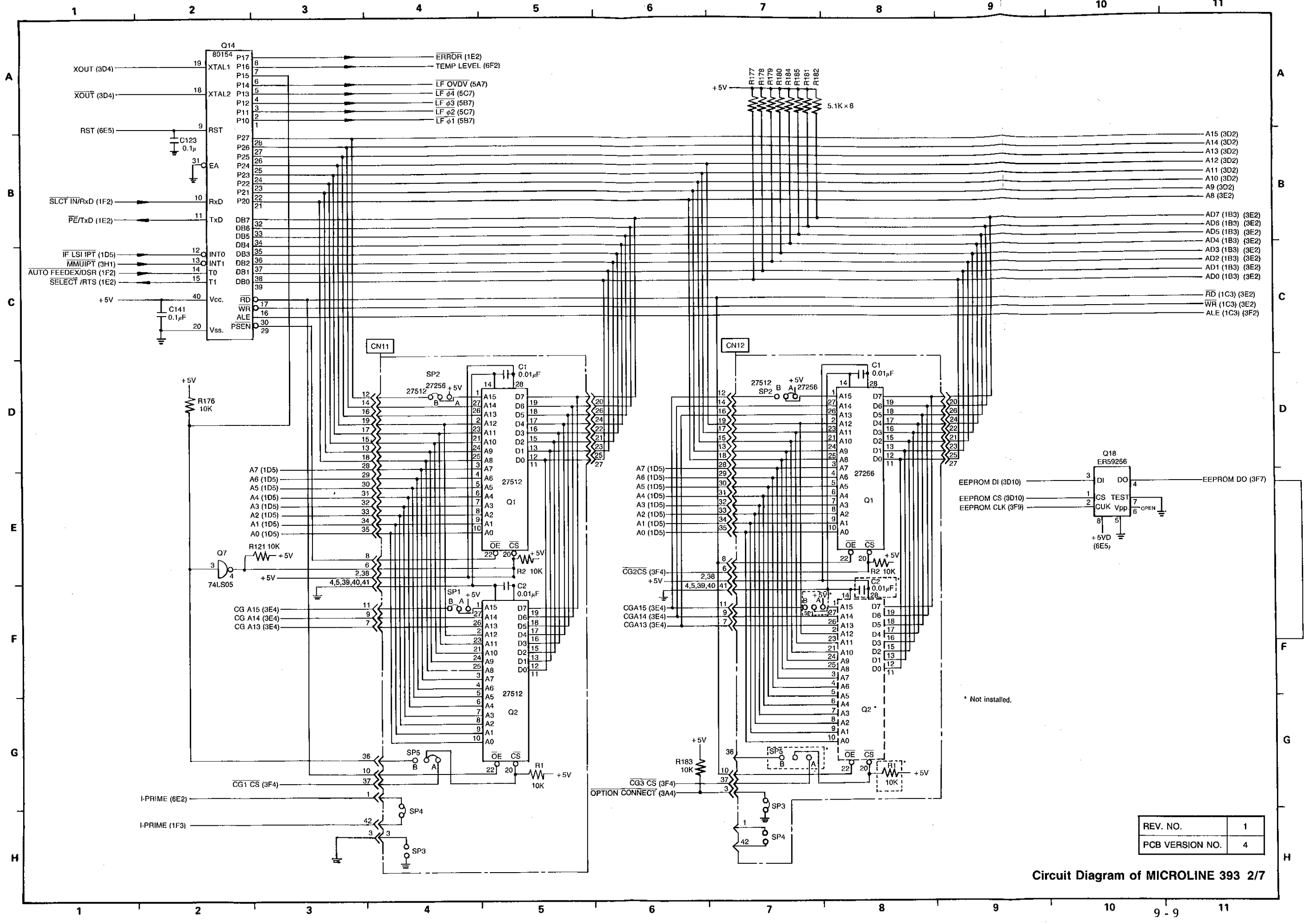
Abbreviation of signal name	Signal name	Function
ODD #13, #15, #17 COM	ODD PIN COMMON	Common driving signal of odd pin.
ODD #19, #21, #23 COM	ODD PIN COMMON	The same as above.
ODD #1DV-ODD #23DV	ODD PIN DRIVE	Odd pin drive command.
ODVC	ODD PIN DRIVE for CENTER	Odd pin drive signal (for center pin).
ODVS	ODD PIN DRIVE for EDGE	Odd pin drive signal (for end pin).
OP CLK	OPERATIONAL PANNEL DATA SHIFT CLOCK	The signal to shift the displayed data on the operational panel and store it in the register to shift.
$\overline{\text{OP RST}}$	OPERATIONAL PANNEL RESET	The signal to erase the display on the operational panel.
OP SD	OPERATIONAL PANNEL SEND DATA	Operational panel display signal.
$\overline{\text{OPTION CONNECT}}$	OPTION FONT CARTRIDGE CONNECT	The signal indicating that ROM cartridge of option font is being connected.
OPTION CONNECT	OPTION FONT CARTRIDGE CONNECT	The same as above.
PE	PAPER END	Centronics interface signal, Paper end signal.
$\overline{\text{PE}}$/TxD	PAPER END or TRANSMIT DATA	When centronics is selected: Paper end signal. When RS232C is selected: Send data for host.
$\overline{\text{POW LOW}}$	POWER SUPPLY LOW	Power supply overload signal.
$\overline{\text{PQ SW}}$	PRINT QUALITY SWITCH	Print quality switch press signal.
$\overline{\text{QUIET SW}}$	QUIET SWITCH	Quiet switch press signal.
RBN ALM	RIBBON DRIVER ALARM	Abnormality detection signal on ribbon motor driver circuit.
RBN COM	RIBBON MOTOR COMMON	Ribbon motor common line.
RBN HP	RIBBON MOTOR HOME POSITION	Ribbon motor home position detection signal.
RBN MO OVDV	RIBBON MOTOR OVER DRIVE	Ribbon motor high voltage drive command.
RBN MO PH1-RBN MO PH4	RIBBON MOTOR DRIVER PHASE n DRIVE	Ribbon motor driver circuit each phase goes to high.
RBN ϕ1 DV-RBN ϕ4 DV	RIBBON MOTOR PHASE n DRIVE	Ribbon motor phase current line.

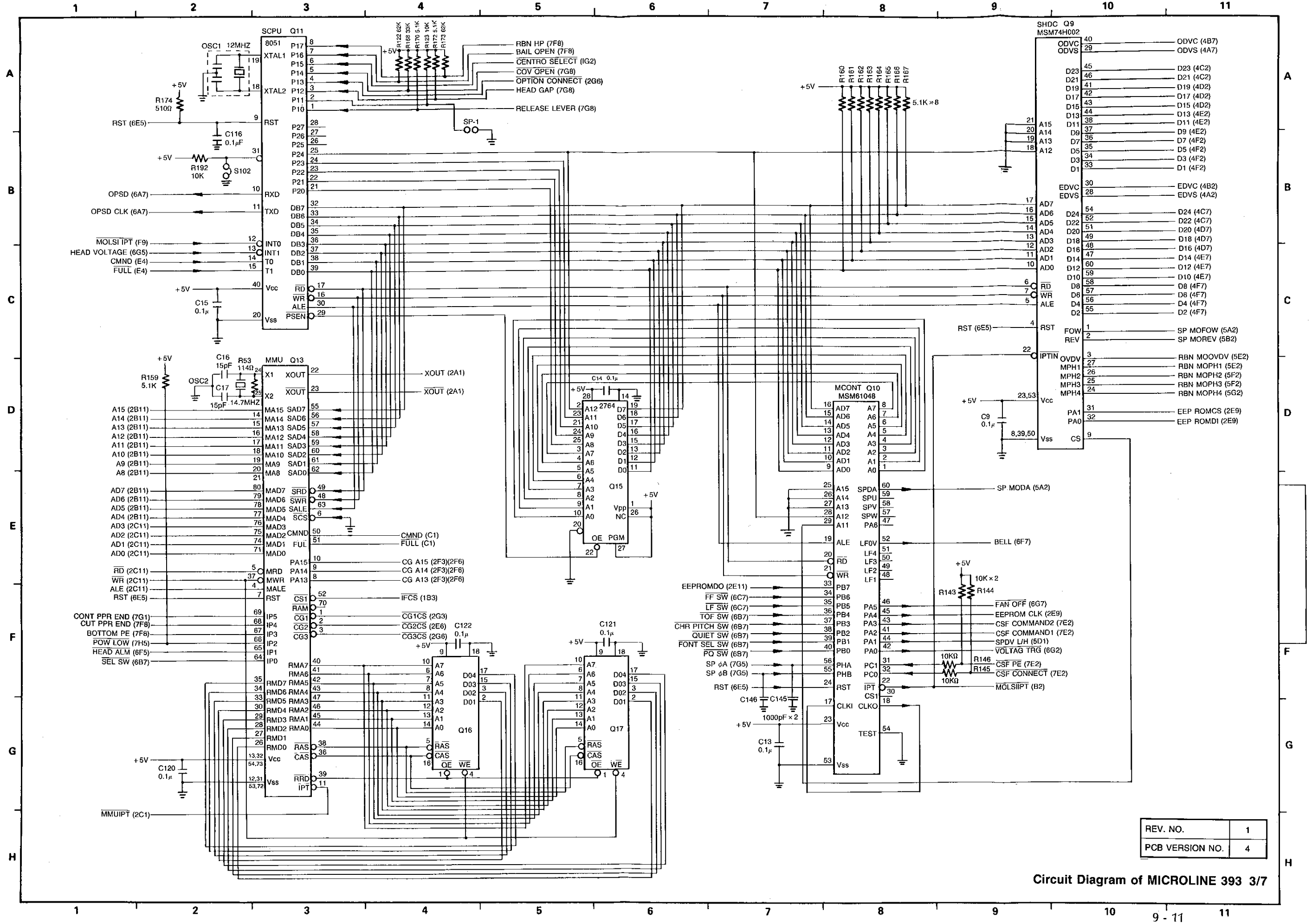
Abbreviation of signal name	Signal name	Function
RD	RECEIVED DATA	RS232C interface signal line that indicates received data.
$\overline{RD}$	READ	Master CPU data read signal.
RELEASE LEVR	PLATEN LOCK RELEASE LEVER	Platen lock release lever state signal.
RET SG	RETURN SIGNAL GROUND	Ground for interface of centronics interface signal.
RST	RESET	Signal to initialize printer.
RTS	REQUEST TO SEND	RS232C interface signal indicating the ready state for reception.
SELECT	SELECT	Reception ready signal.
$\overline{SELECT\ IN}$	SELECT IN	Unused.
$\overline{SELECT}$/RTS	SELECT or REQUEST TO SEND	The signal to indicate the ready state for reception.
$\overline{SEL\ SW}$	SELECT SWITCH	Select switch press signal.
SG	SIGNAL GROUND	Ground for logical circuit.
$\overline{SLCT\ IN}$/RxD	SELECT IN or RECEIVED DATA	When centronics is selected: Unused. When RS232C is selected: Receive signal.
SP DV H/L	SPACING MOTOR DRIVE CURRENT HIGH/LOW	Spacing motor current setting switching signal.
SPM1	SPACING MOTOR PHASE1	Spacing motor current line.
SPM2	SPACING MOTOR PHASE2	The same above.
SP MO FOW	SPACING MOTOR FOWARD	Spacing motor forward rotation command signal.
SP MO REV	SPACING MOTOR REVERSE	Spacing motor reverse rotation command signal.
SP ϕA	SPACING MOTOR SLIT ENCODER PHASE A	Spacing motor slit encoder phase A output.
SP ϕB	SPACING MOTOR SLIT ENCODER PHASE B	Spacing motor slit encoder phase B output.
SSD	SUPERVISORY SEND DATA	RS232C interface signal indicating the ready state for reception.
$\overline{STB}$	DATA STROBE	Centronics interface signal. The timing signal to cause the printer to receive a data.
TD	TRANSMITTED DATA	RS232C interface signal. Send data to host.

Abbreviation of signal name	Signal name	Function
TEMP LEVEL	TEMPERATURE LEVEL	Printing head temperature alarm level setting signal.
$\overline{\text{TOF SW}}$	TOP OF FORM SWITCH	TOF switch press signal.
BAIL OPEN	PAPER BAIL OPEN	Bail bar open detection signal.
$\overline{\text{VOLTAG TRG}}$	VOLTAGE SENSE TRIGGER	Voltage detection circuit operation trigger.
$\overline{\text{WR}}$	WRITE	Data write signal of master CPU.
XOUT	CRYSTAL OSCILLATOR OUTPUT	Crystal oscillating circuit output.
$\overline{\text{XOUT}}$	CRYSTAL OSCILLATOR OUTPUT	The same as above.
-8V	-8 Volt	Power supply for RS232C interface circuit.
+38V	+38V Volt	Power supply for driver circuit.
+5V	+5V Volt	Power supply for logical circuit.
+8V	+8V Volt	Power supply for RS232C interface circuit.

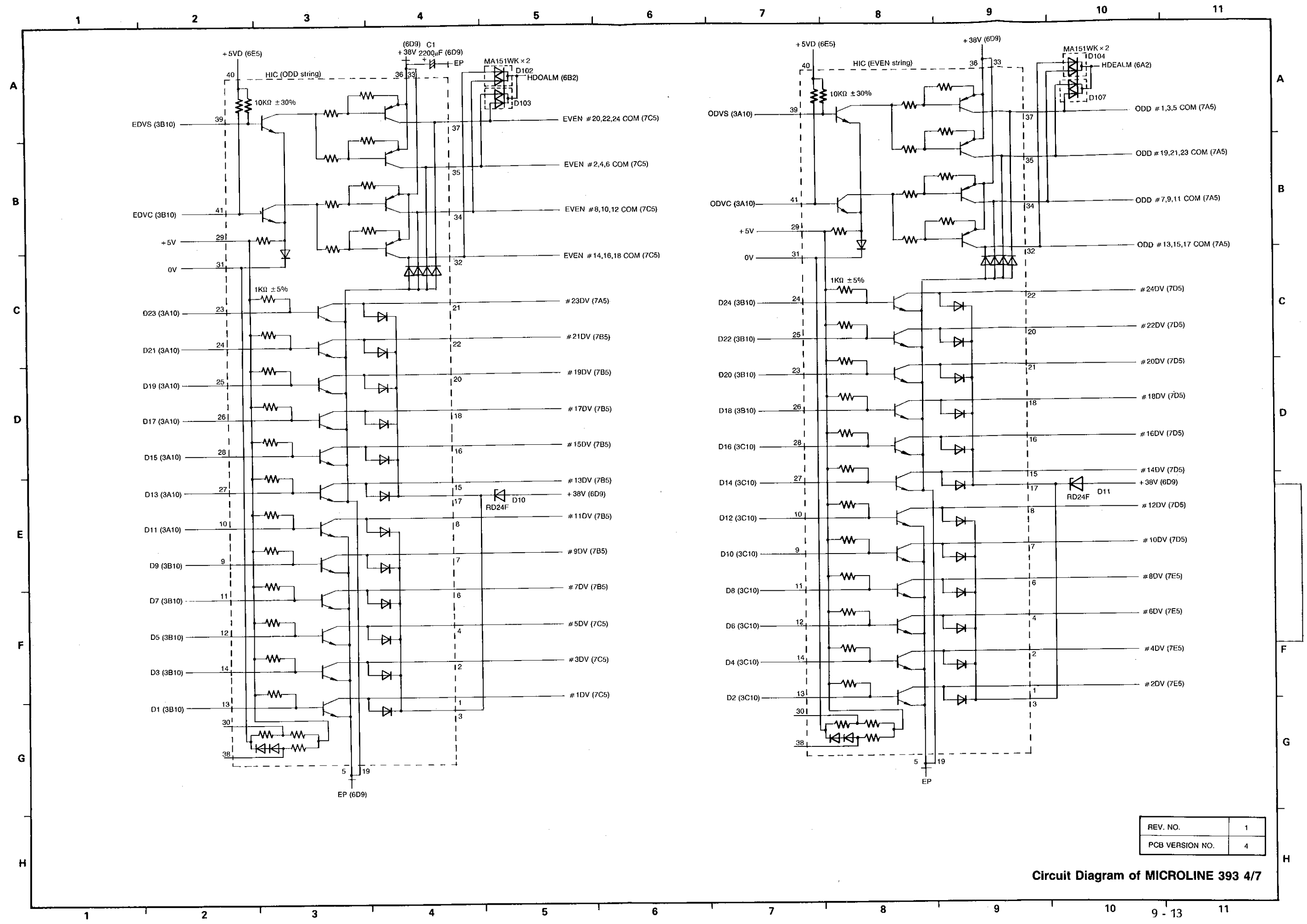


Circuit Diagram of MICROLINE 393 1/7


Q14
80154
XOUT (3D4)
XOUT (3D4)
RST (6E5)
C123 0.1μ
EA
SLCT IN/RxD (1F2)
PE/TxD (1E2)
IF LSI IPT (1D5)
MMUIPT (3H1)
AUTO FEEDEX/DSR (1F2)
SELECT /RTS (1E2)
+5V
C141 0.1μF
XTAL1
XTAL2
RST
RxD
TxD
INT0
INT1
T0
T1
Vcc.
Vss.
P17
P16
P15
P14
P13
P12
P11
P10
P27
P26
P25
P24
P23
P22
P21
P20
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
RD
WR
ALE
PSEN
ERROR (1E2)
TEMP LEVEL (6F2)
LF OVDV (5A7)
LF φ4 (5C7)
LF φ3 (5B7)
LF φ2 (5C7)
LF φ1 (5B7)
R177
R178
R179
R180
R184
R185
R181
R182
5.1K x 8
A15 (3D2)
A14 (3D2)
A13 (3D2)
A12 (3D2)
A11 (3D2)
A10 (3D2)
A9 (3D2)
A8 (3E2)
AD7 (1B3) (3E2)
AD6 (1B3) (3E2)
AD5 (1B3) (3E2)
AD4 (1B3) (3E2)
AD3 (1B3) (3E2)
AD2 (1B3) (3E2)
AD1 (1B3) (3E2)
AD0 (1B3) (3E2)
RD (1C3) (3E2)
WR (1C3) (3E2)
ALE (1C3) (3F2)
CN11
CN12
SP2
27512
27256
C1 0.01μF
R176 10K
A7 (1D5)
A6 (1D5)
A5 (1D5)
A4 (1D5)
A3 (1D5)
A2 (1D5)
A1 (1D5)
A0 (1D5)
Q1
Q2
OE
CS
R2 10K
C2 0.01μF
Q7
74LS05
R121 10K
SP1
CG A15 (3E4)
CG A14 (3E4)
CG A13 (3E4)
CG1 CS (3F4)
I-PRIME (6E2)
I-PRIME (1F3)
SP4
SP3
SP5
R1 10K
CG2 CS (3F4)
CGA15 (3E4)
CGA14 (3E4)
CGA13 (3E4)
CG3 CS (3F4)
OPTION CONNECT (3A4)
R183 10K
Q18
ER59256
EEPROM DI (3D10)
EEPROM CS (3D10)
EEPROM CLK (3F9)
EEPROM DO (3F7)
+5VD (6E5)
* Not installed.
REV. NO. 1
PCB VERSION NO. 4
Circuit Diagram of MICROLINE 393 2/7

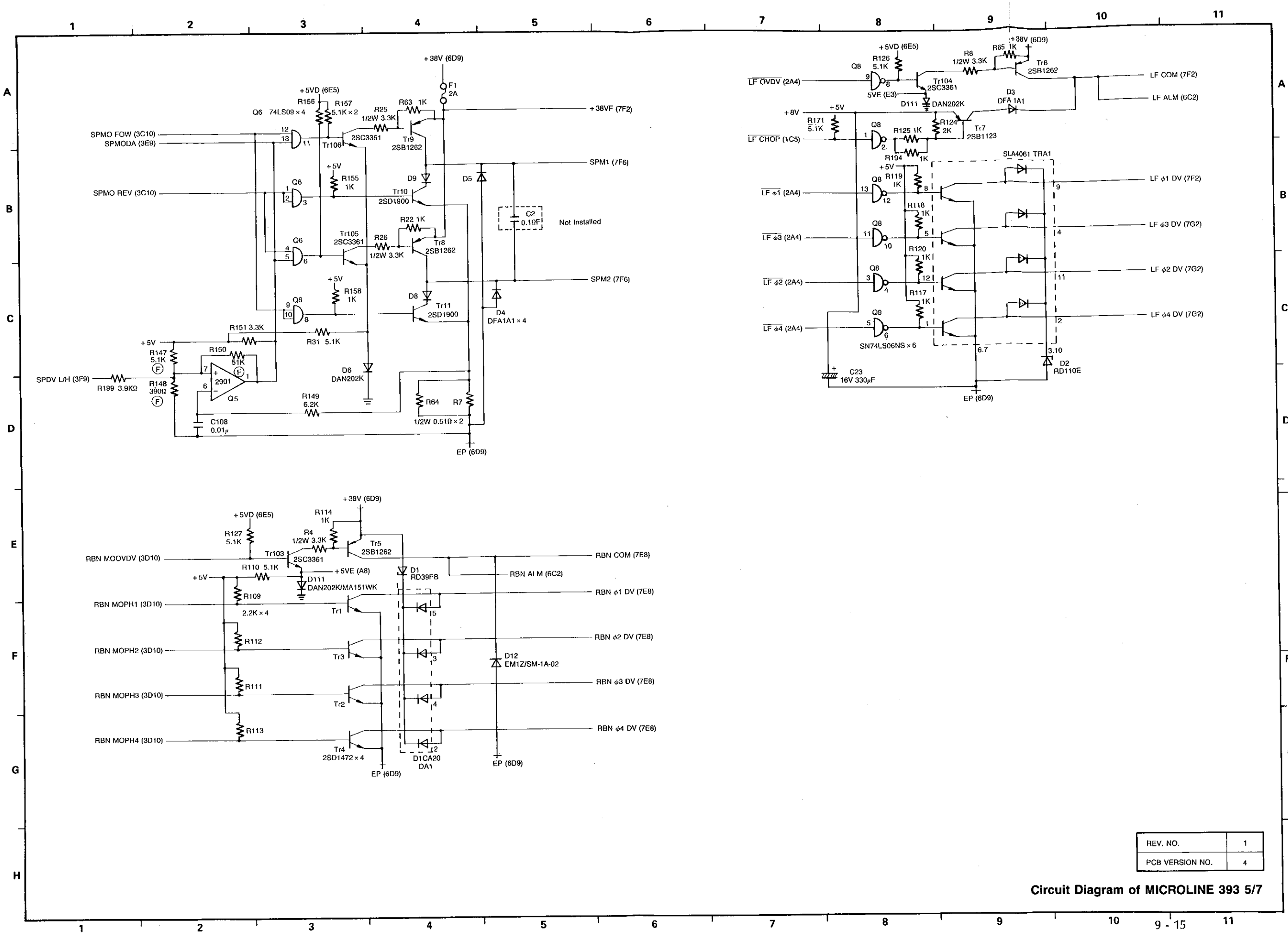


Circuit Diagram of MICROLINE 393 3/7



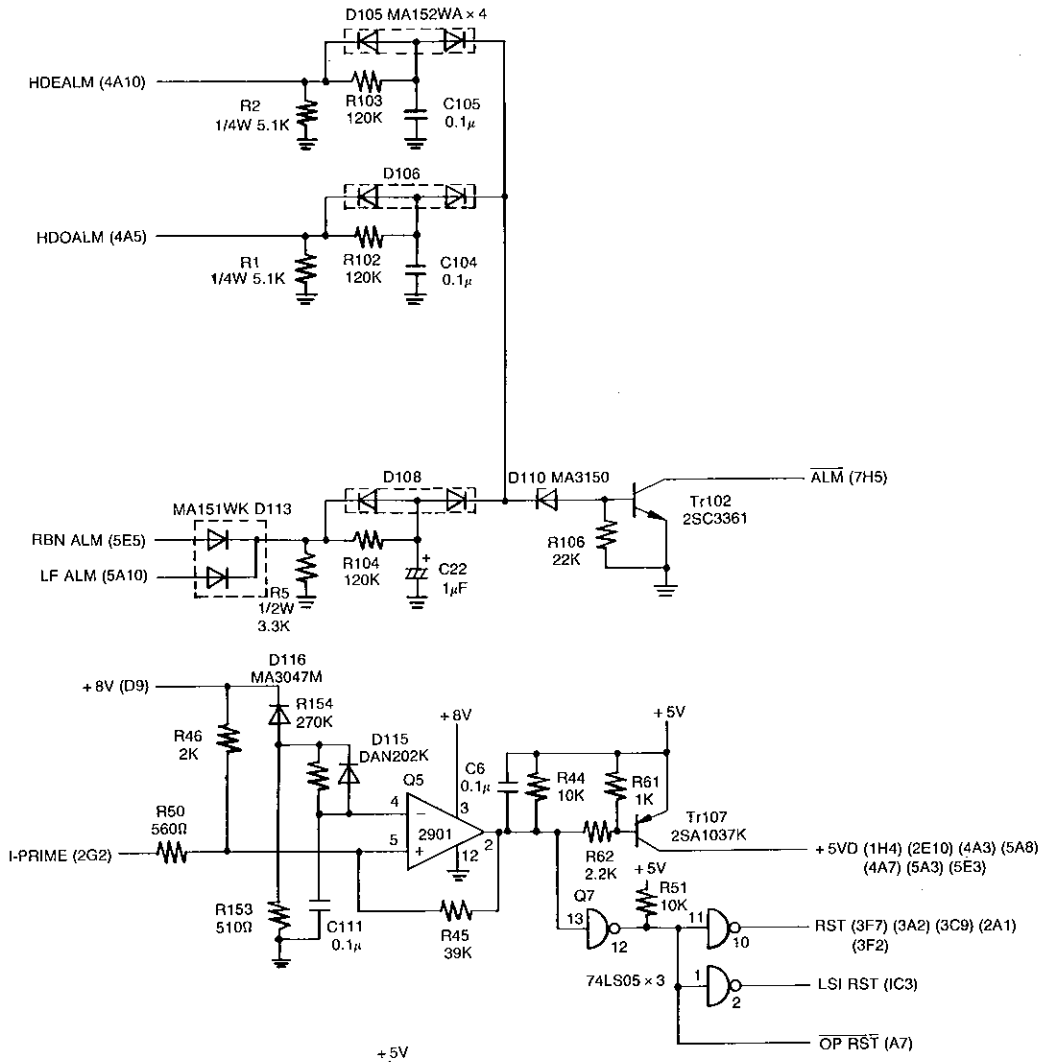
REV. NO.	1
PCB VERSION NO.	4

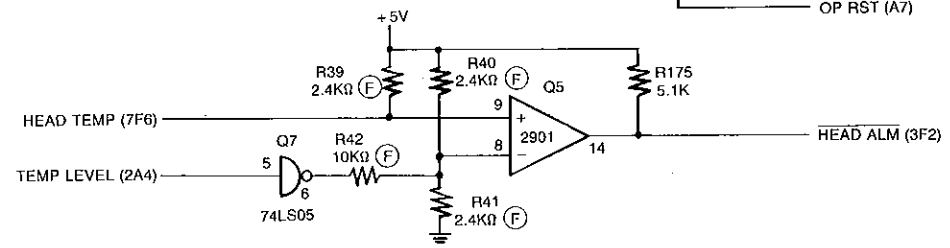
Circuit Diagram of MICROLINE 393 4/7

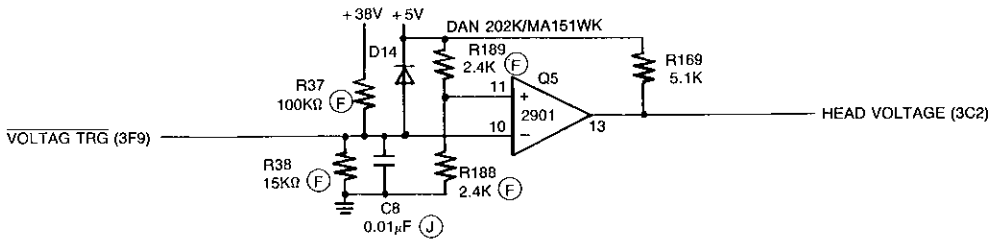


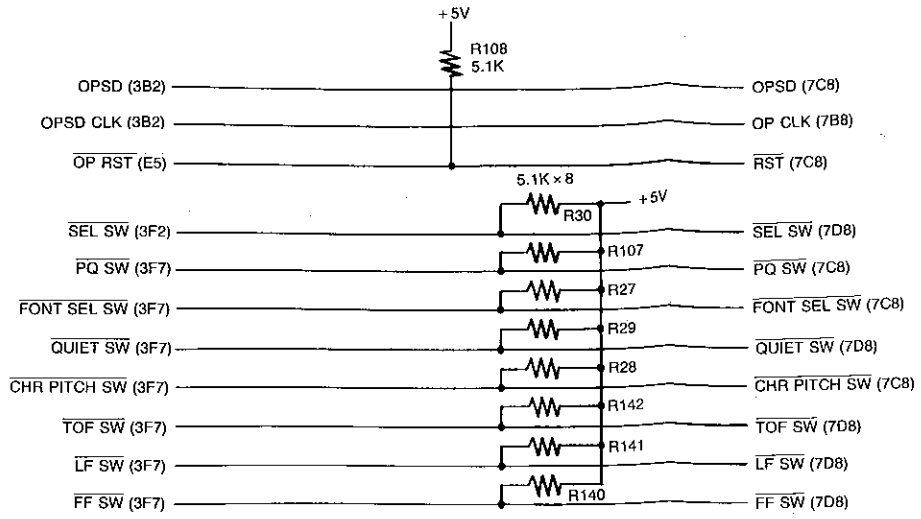
REV. NO.	1
PCB VERSION NO.	4

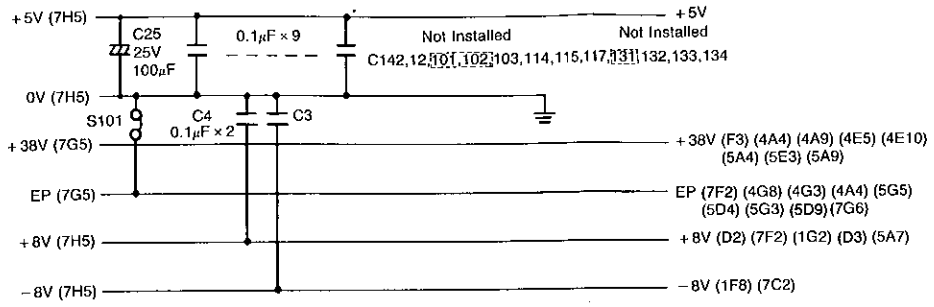
Circuit Diagram of MICROLINE 393 5/7

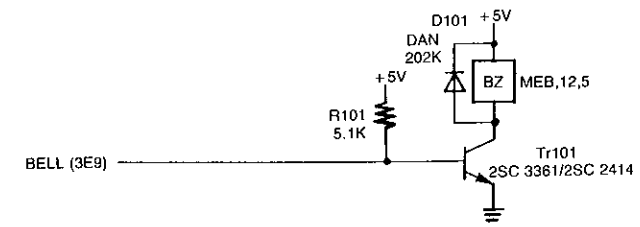


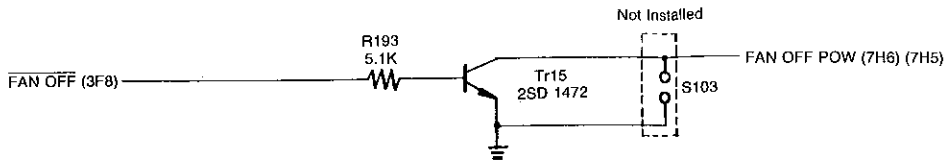






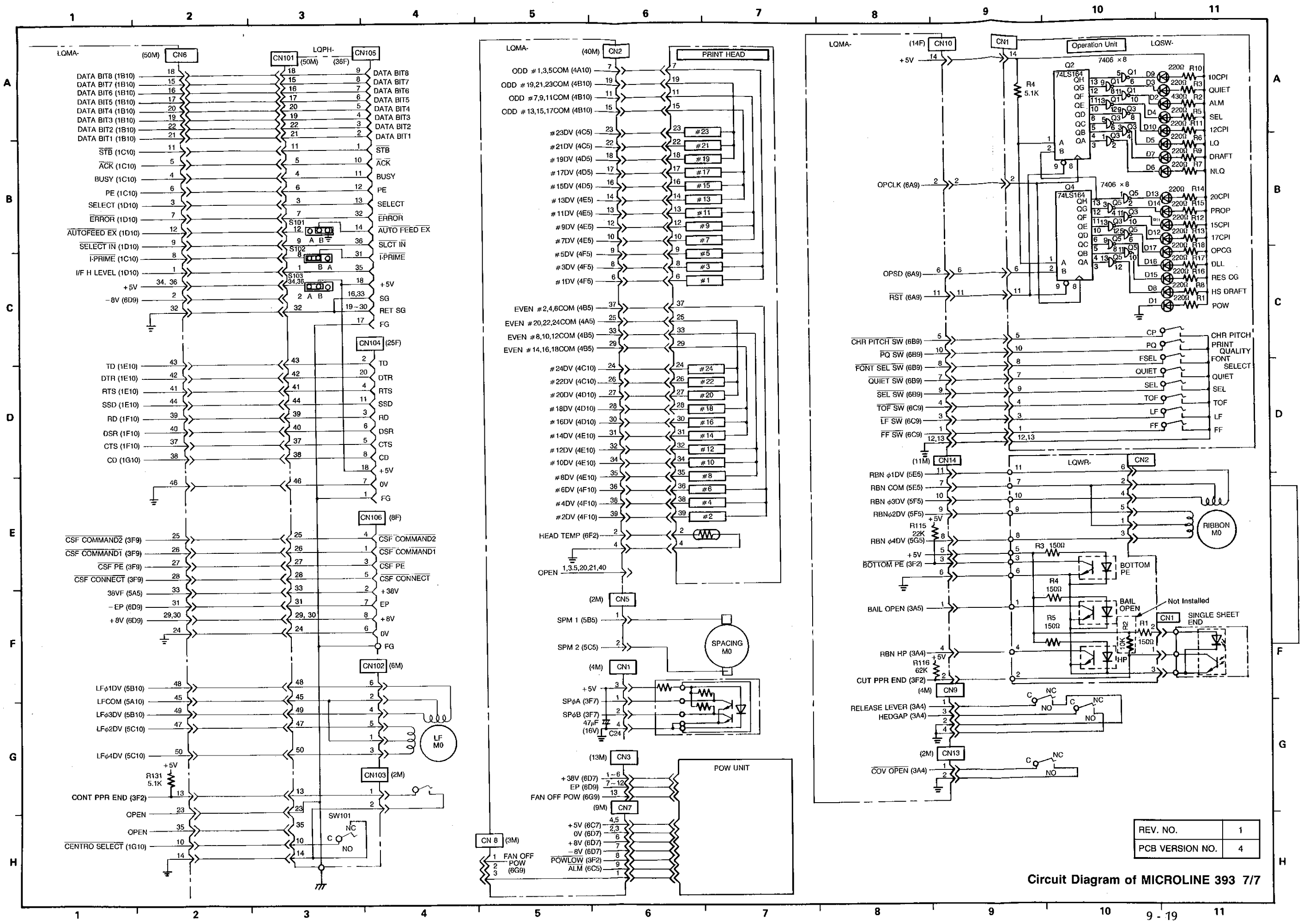




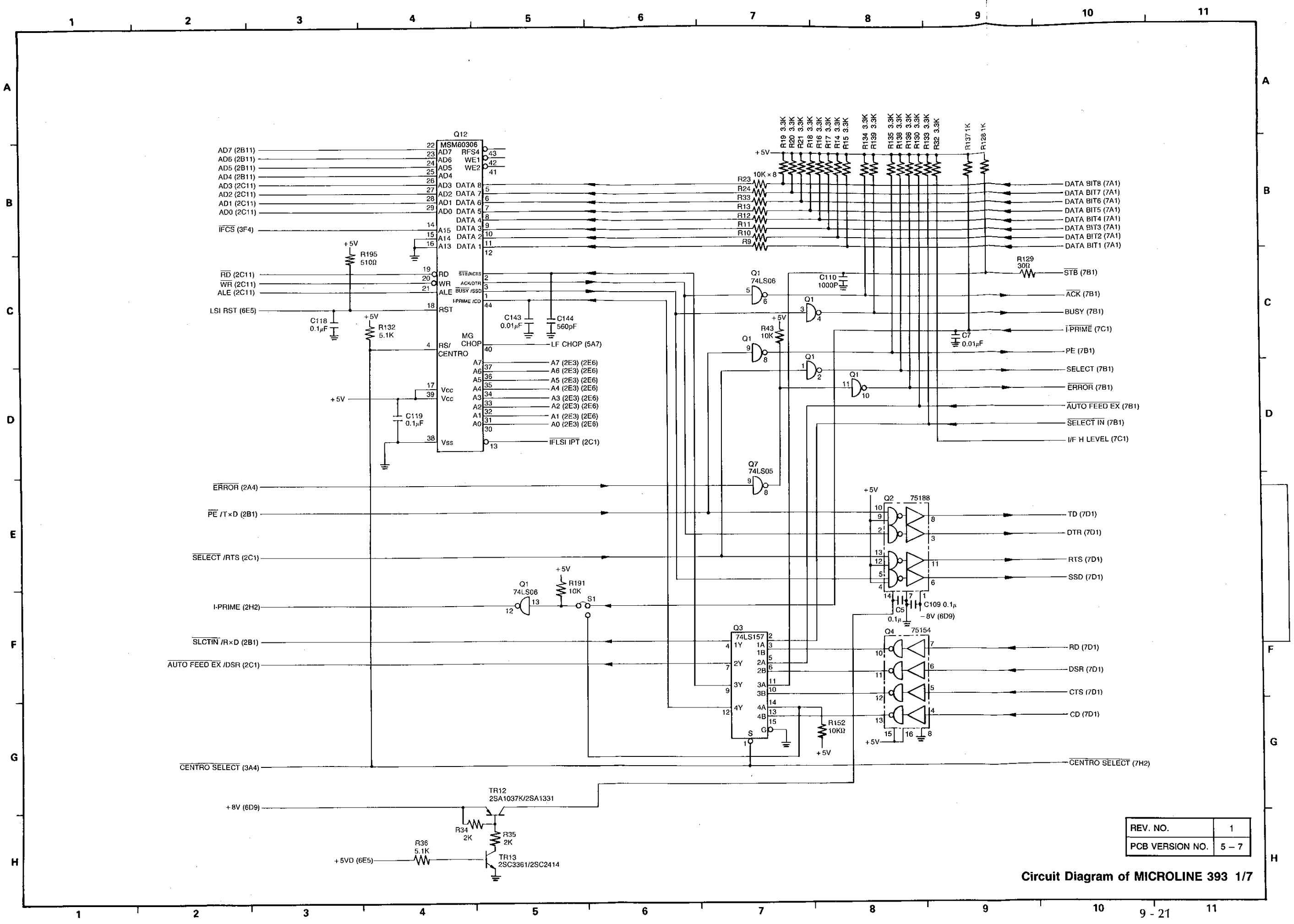


REV. NO.	1
PCB VERSION NO.	4

Circuit Diagram of MICROLINE 393 6/7

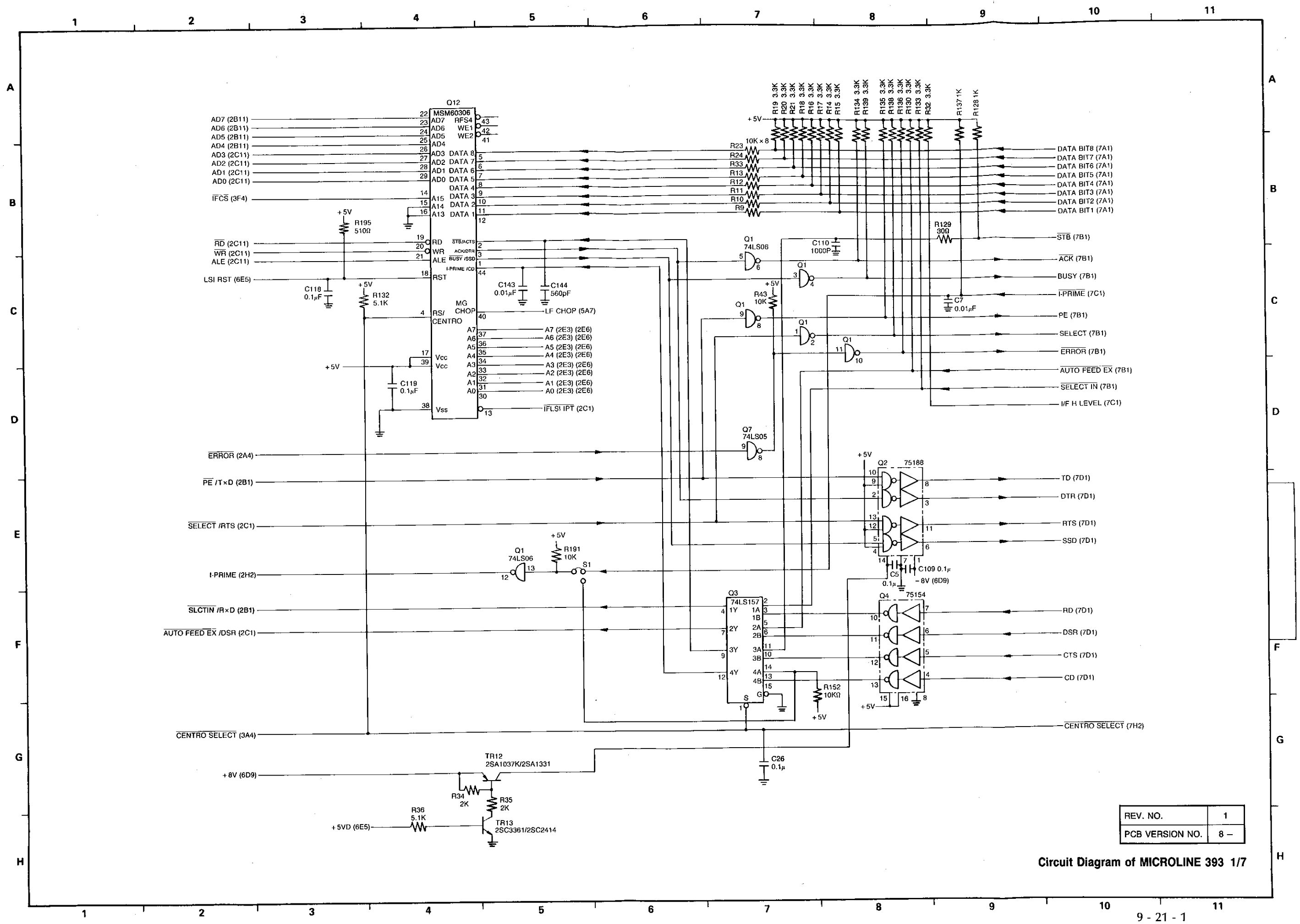


Circuit Diagram of MICROLINE 393 7/7



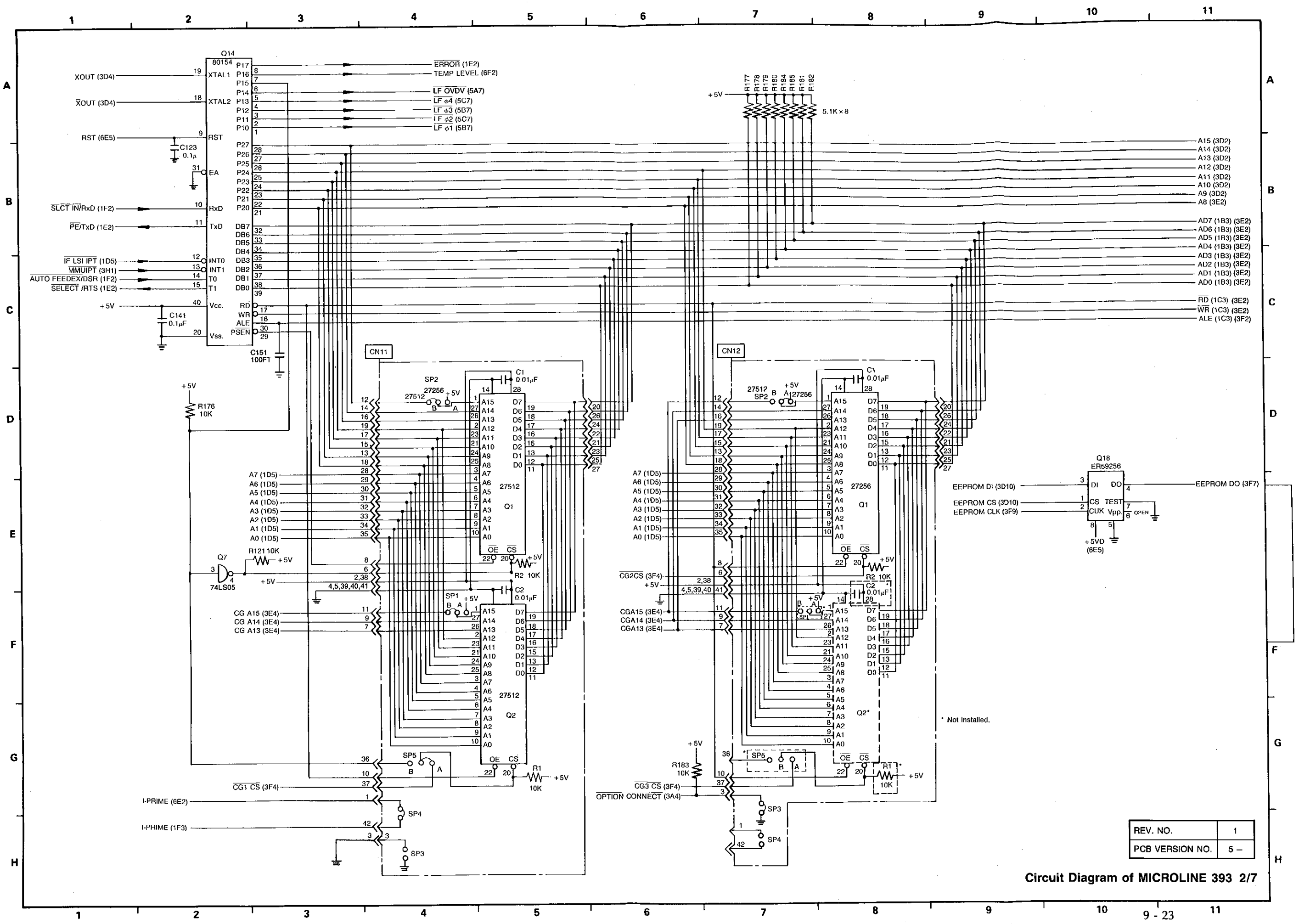
REV. NO.	1
PCB VERSION NO.	5 – 7

Circuit Diagram of MICROLINE 393 1/7



REV. NO.	1
PCB VERSION NO.	8 –

Circuit Diagram of MICROLINE 393 1/7


Q14
80154
XOUT (3D4)
XOUT (3D4)
RST (6E5)
C123 0.1μ
SLCT IN/RxD (1F2)
PE/TxD (1E2)
IF LSI IPT (1D5)
MMUIPT (3H1)
AUTO FEEDEX/DSR (1F2)
SELECT /RTS (1E2)
+5V
C141 0.1μF
C151 100FT
XTAL1
XTAL2
RST
EA
RxD
TxD
INT0
INT1
T0
T1
Vcc.
Vss.
P17
P16
P15
P14
P13
P12
P11
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P27
P26
P25
P24
P23
P22
P21
P20
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
RD
WR
ALE
PSEN
ERROR (1E2)
TEMP LEVEL (6F2)
LF OVDV (5A7)
LF φ4 (5C7)
LF φ3 (5B7)
LF φ2 (5C7)
LF φ1 (5B7)
R177 R178 R179 R180 R184 R185 R181 R182
5.1K×8
A15 (3D2)
A14 (3D2)
A13 (3D2)
A12 (3D2)
A11 (3D2)
A10 (3D2)
A9 (3D2)
A8 (3E2)
AD7 (1B3) (3E2)
AD6 (1B3) (3E2)
AD5 (1B3) (3E2)
AD4 (1B3) (3E2)
AD3 (1B3) (3E2)
AD2 (1B3) (3E2)
AD1 (1B3) (3E2)
AD0 (1B3) (3E2)
RD (1C3) (3E2)
WR (1C3) (3E2)
ALE (1C3) (3F2)
CN11
CN12
SP2
27512
27256
C1 0.01μF
R176 10K
A7 (1D5)
A6 (1D5)
A5 (1D5)
A4 (1D5)
A3 (1D5)
A2 (1D5)
A1 (1D5)
A0 (1D5)
Q1
Q2
OE
CS
R121 10K
Q7
74LS05
R2 10K
C2 0.01μF
SP1
CG A15 (3E4)
CG A14 (3E4)
CG A13 (3E4)
CG1 CS (3F4)
CG2CS (3F4)
CGA15 (3E4)
CGA14 (3E4)
CGA13 (3E4)
CG3 CS (3F4)
OPTION CONNECT (3A4)
R183 10K
R1 10K
R1* 10K
SP5
SP4
SP3
I-PRIME (6E2)
I-PRIME (1F3)
Q18
ER59256
EEPROM DI (3D10)
EEPROM CS (3D10)
EEPROM CLK (3F9)
EEPROM DO (3F7)
+5VD (6E5)
* Not installed.
REV. NO. 1
PCB VERSION NO. 5 –
Circuit Diagram of MICROLINE 393 2/7

Note: Connection of SP1

Monochrome	OPEN
Color	SHORT

REV. NO.	1
PCB VERSION NO.	5 – 7

Circuit Diagram of MICROLINE 393 3/7

SCPU Q11 MSM80C51F-520RS

OSC1 12MHZ

Note: Connection of SP1

Monochrome	OPEN
Color	SHORT

Not installed

MMU Q13

OSC2 14.7MHZ

Q15 2764

Q16

Q17

MCONT Q10 MSM61048

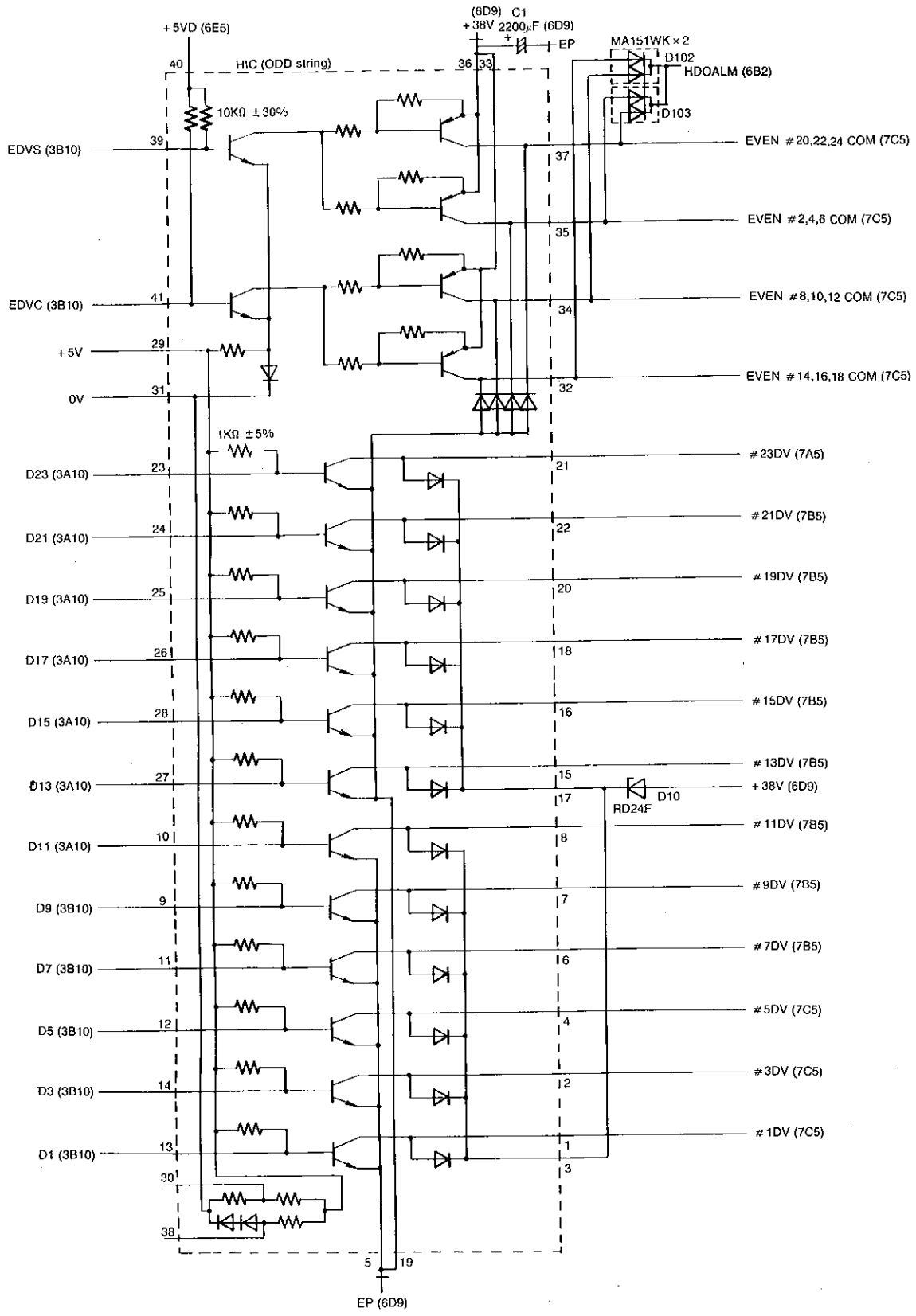
SHDC Q9 MSM74H002

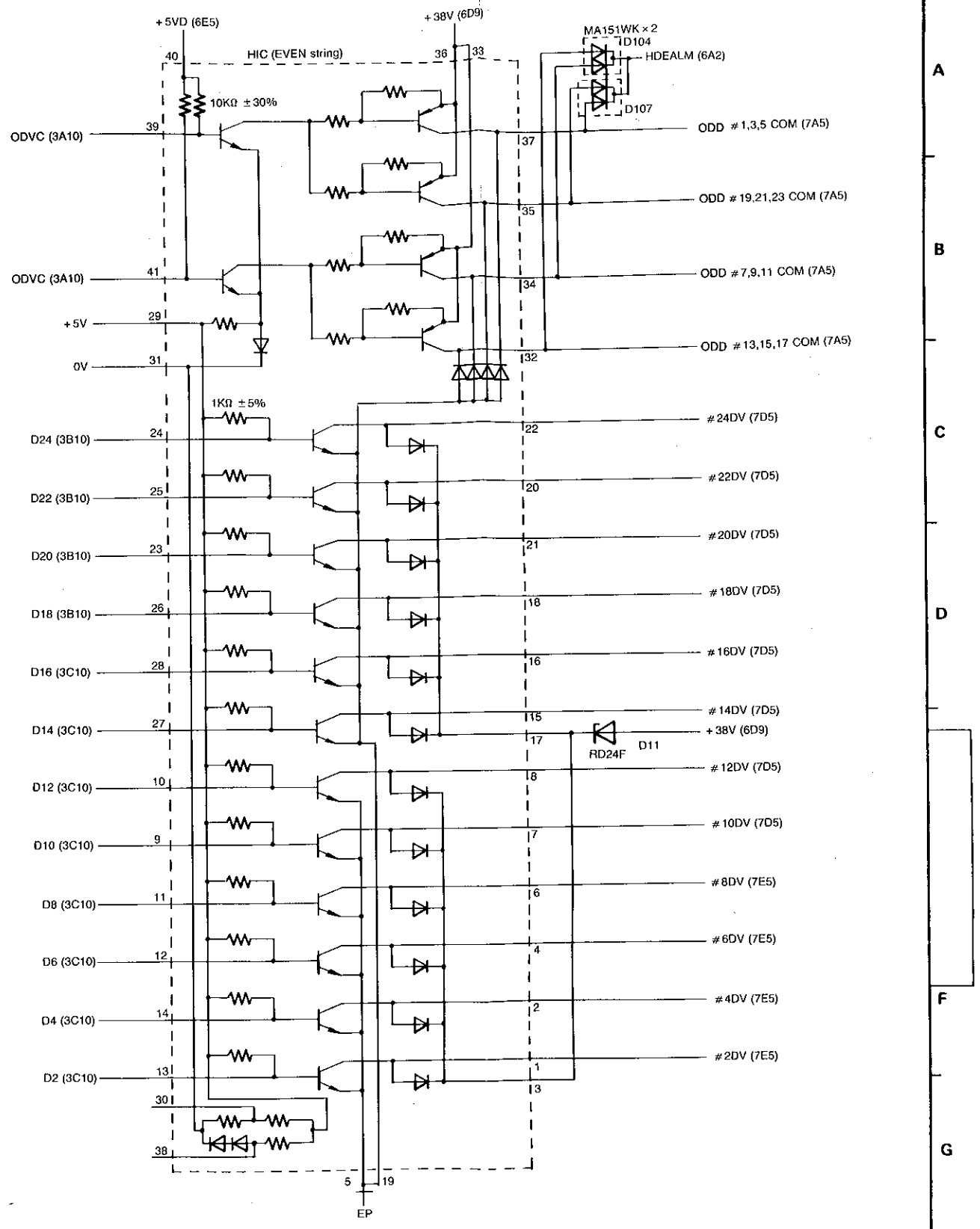
C154 C155 0.1μF × 2

C152 C53 0.1μF × 2

REV. NO.	1
PCB VERSION NO.	8 –

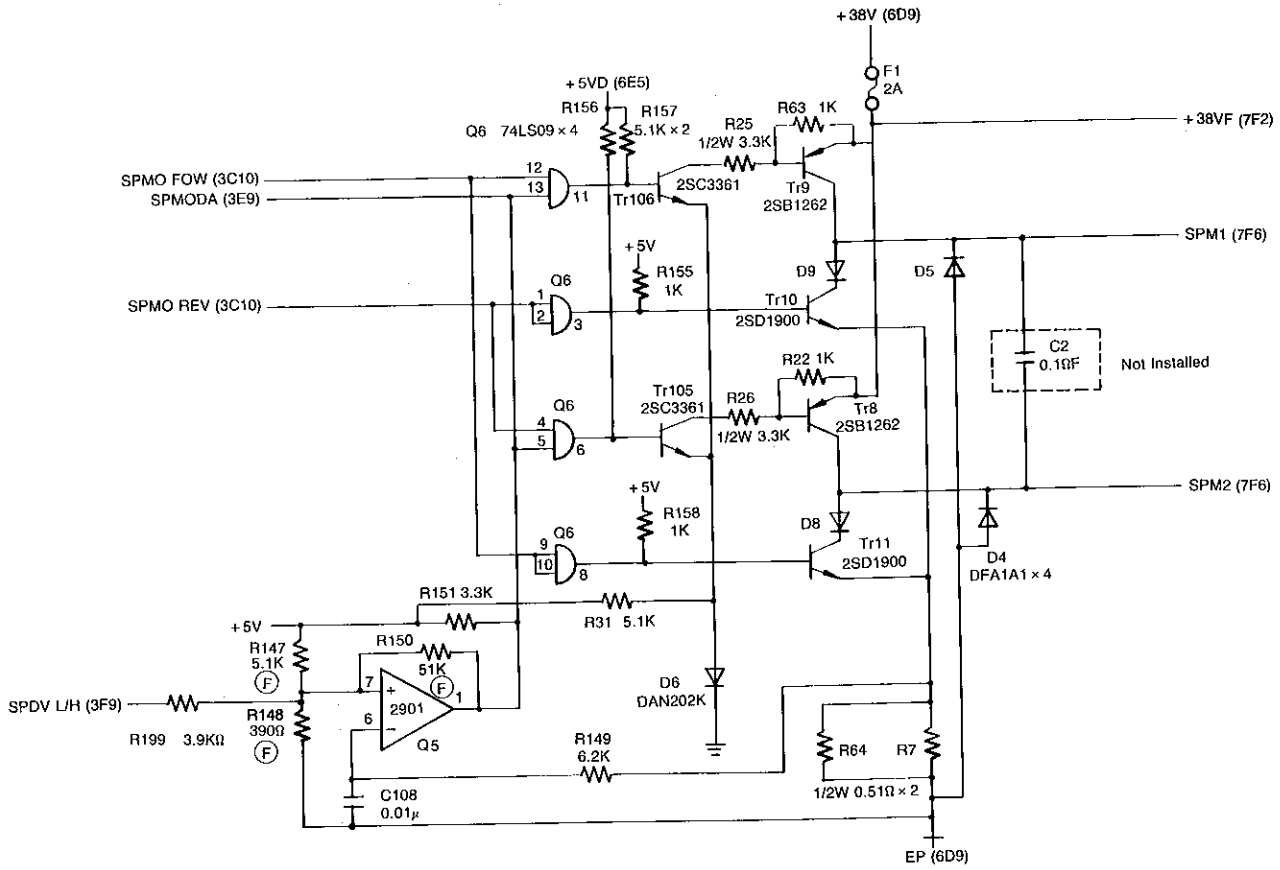
Circuit Diagram of MICROLINE 393 3/7

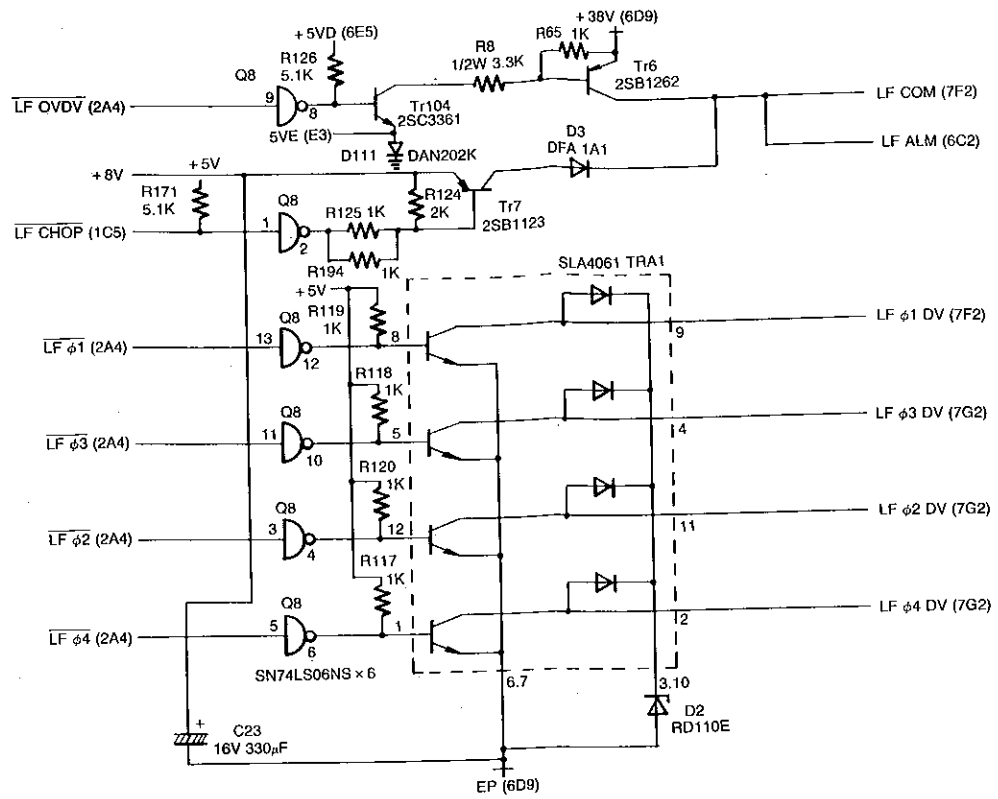


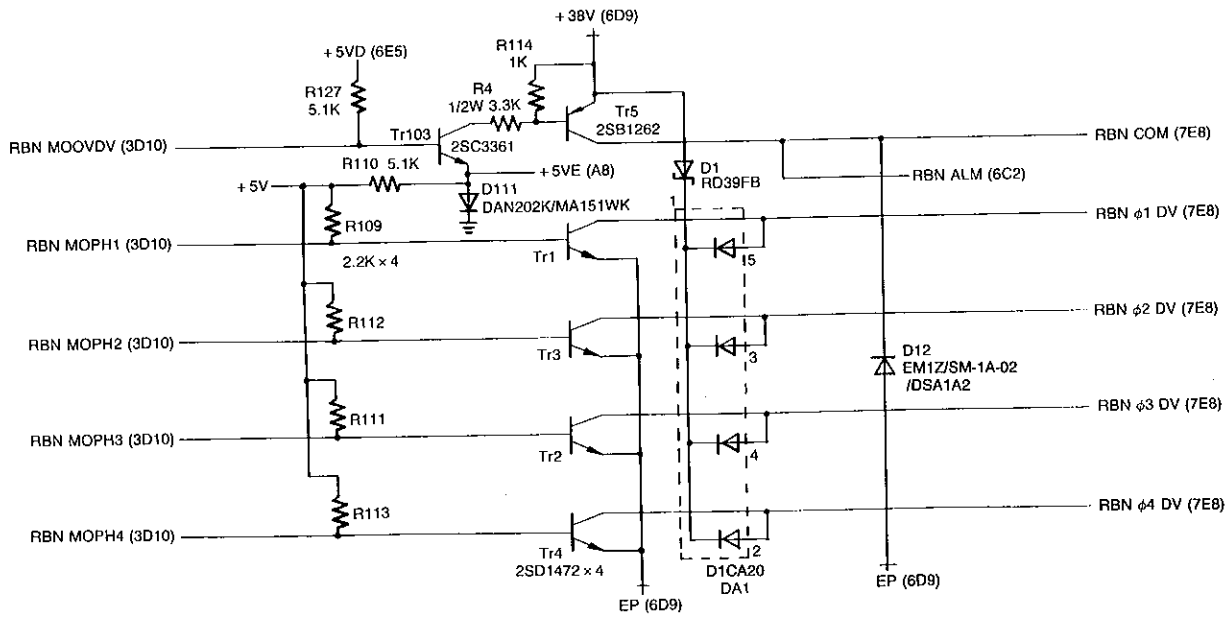


REV. NO.	1
PCB VERSION NO.	5 –

Circuit Diagram of MICROLINE 393 4/7

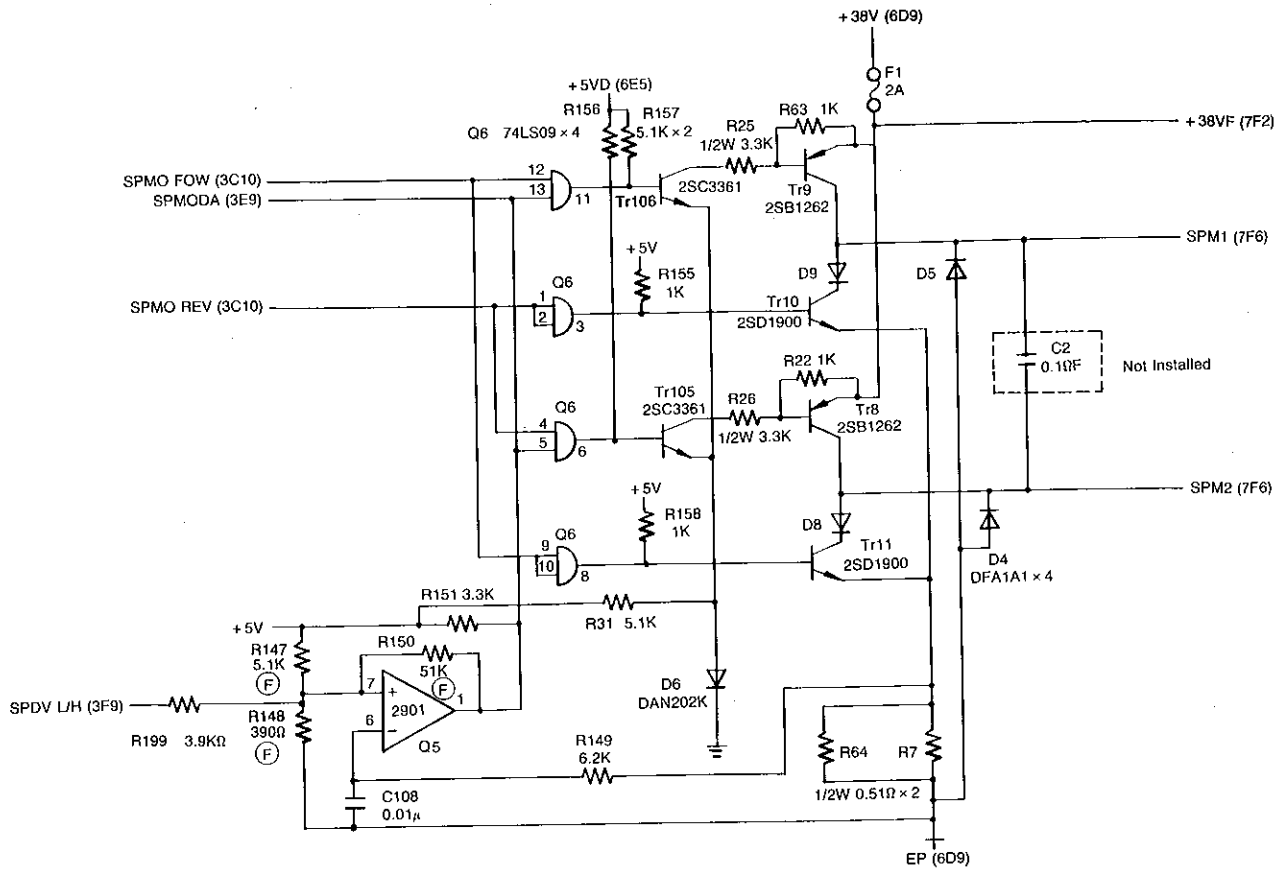


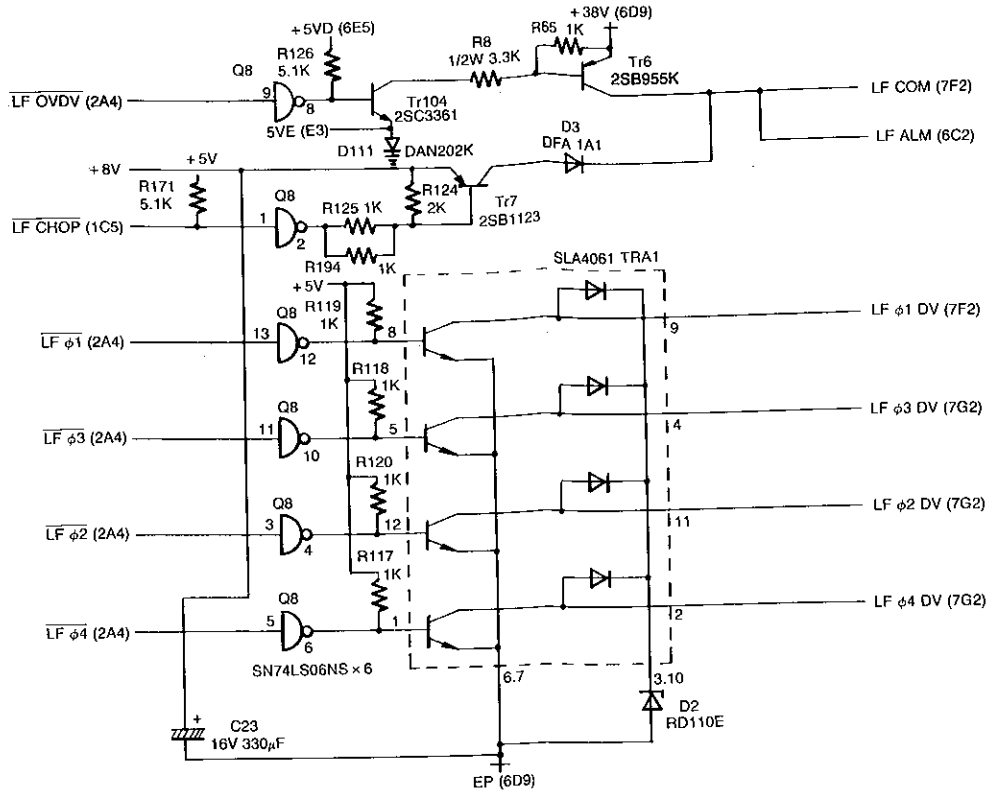


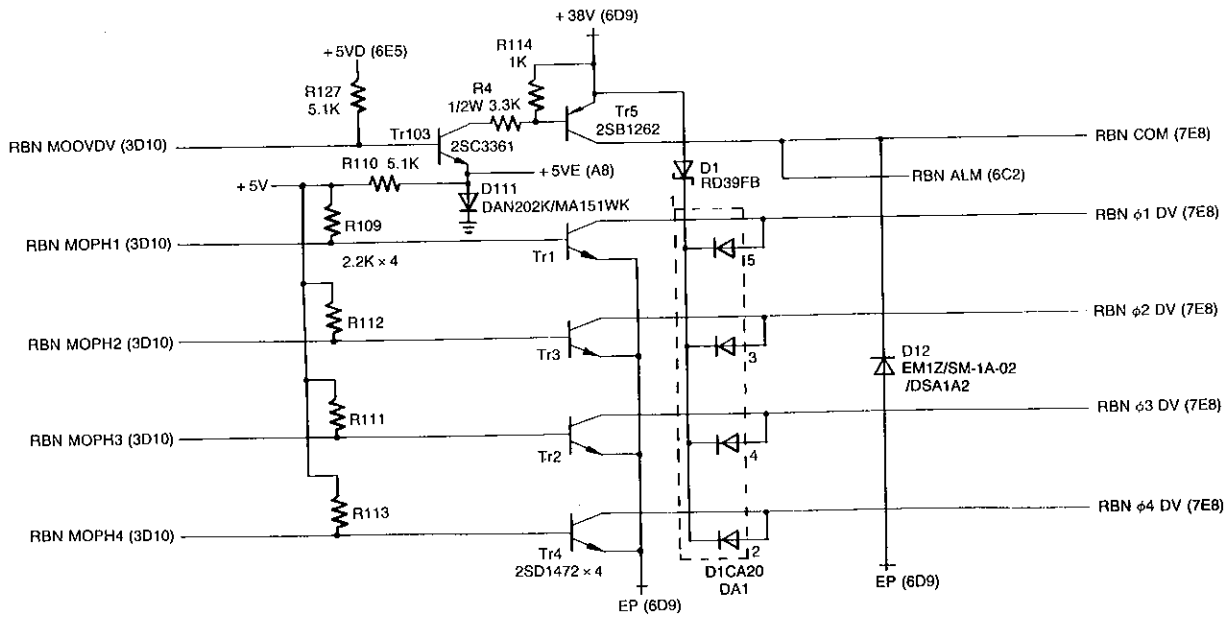


REV. NO.	1
PCB VERSION NO.	5, 6

Circuit Diagram of MICROLINE 393 5/7

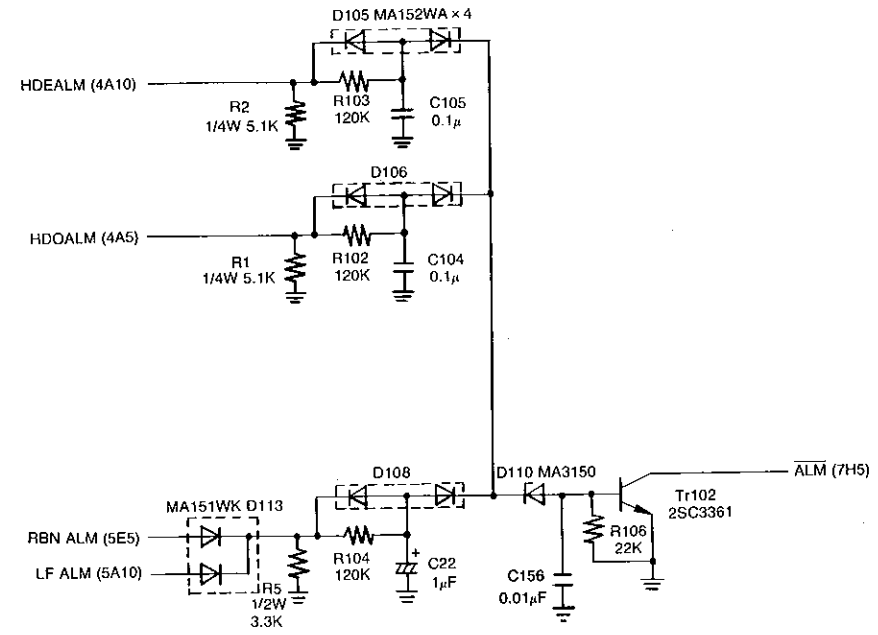


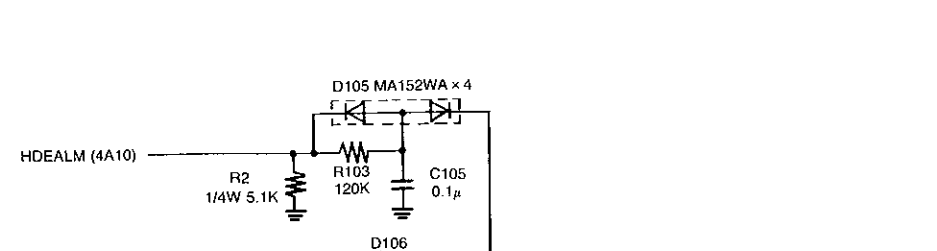


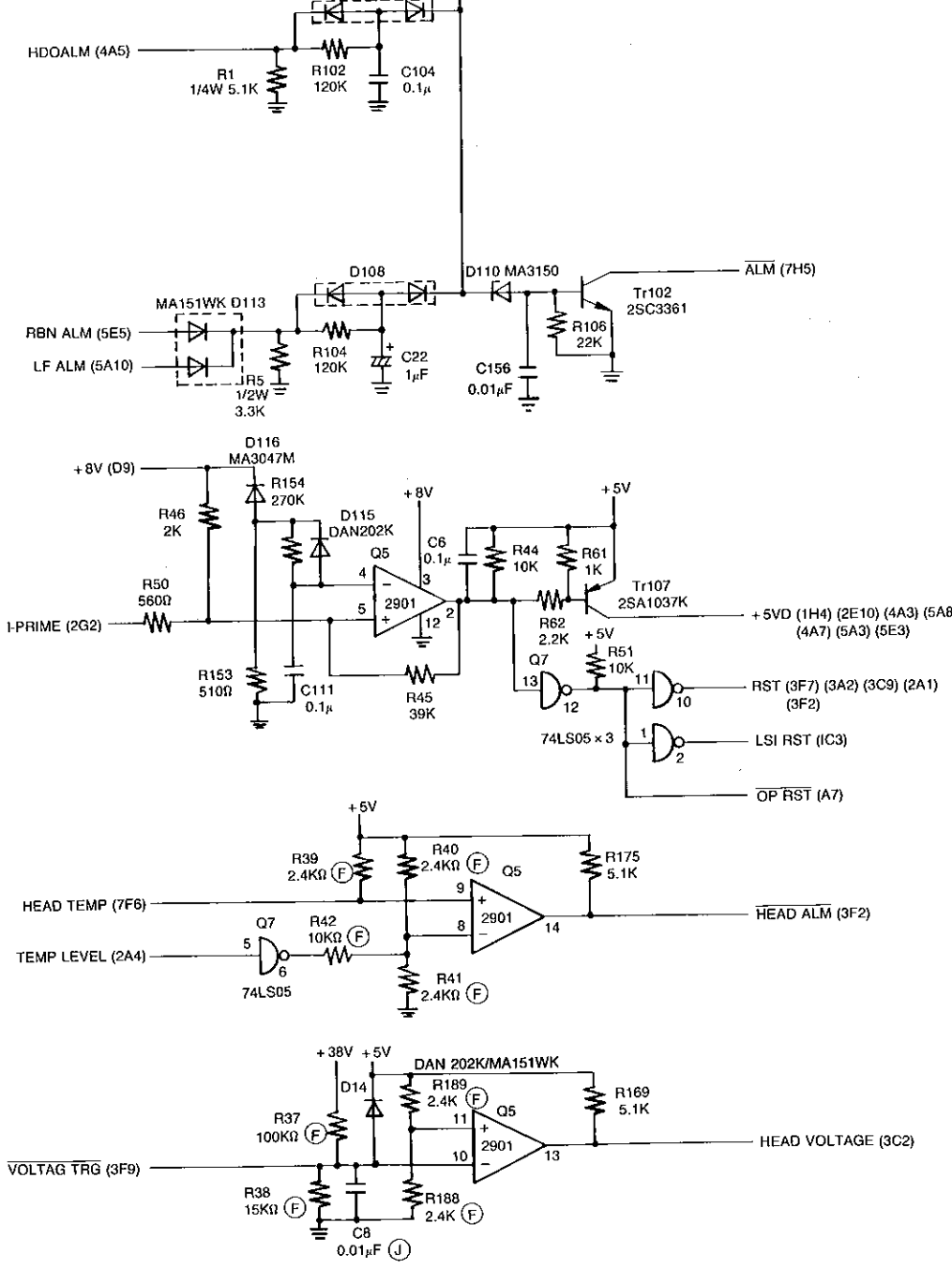


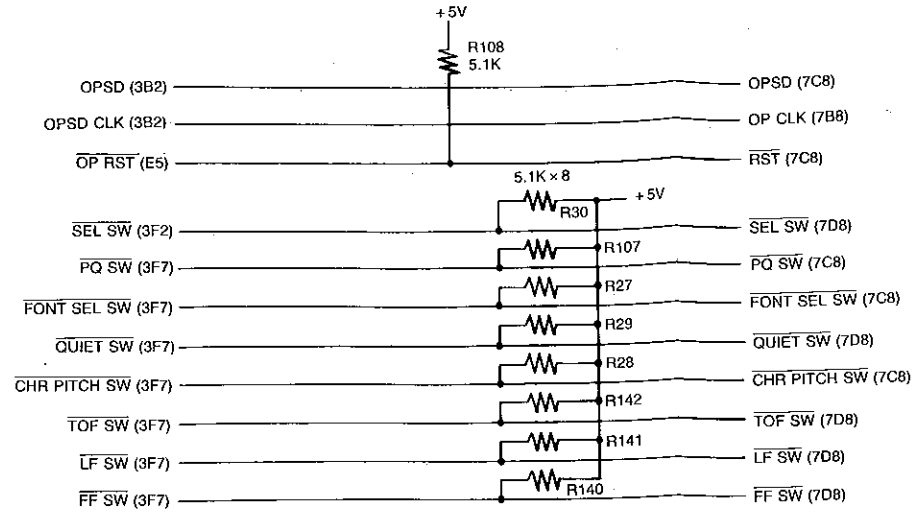
REV. NO.	1
PCB VERSION NO.	7 –

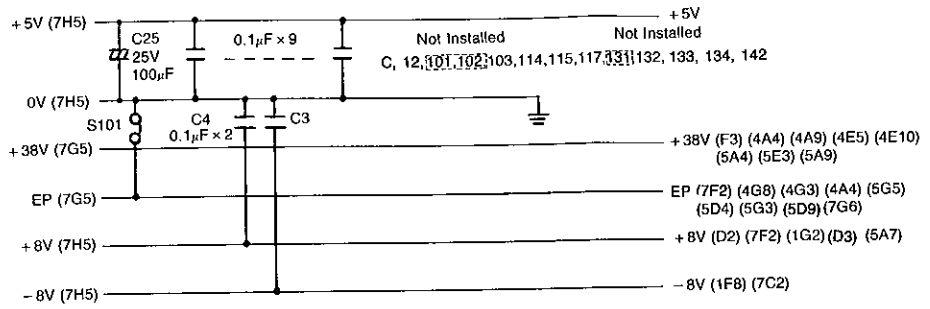
Circuit Diagram of MICROLINE 393 5/7

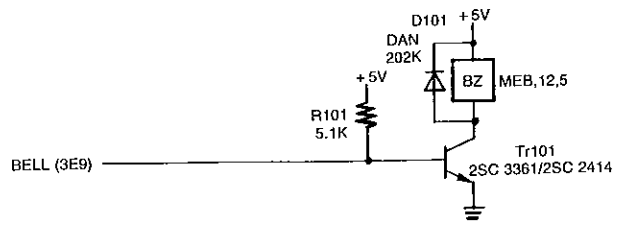


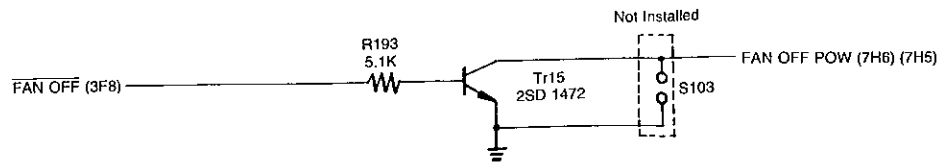






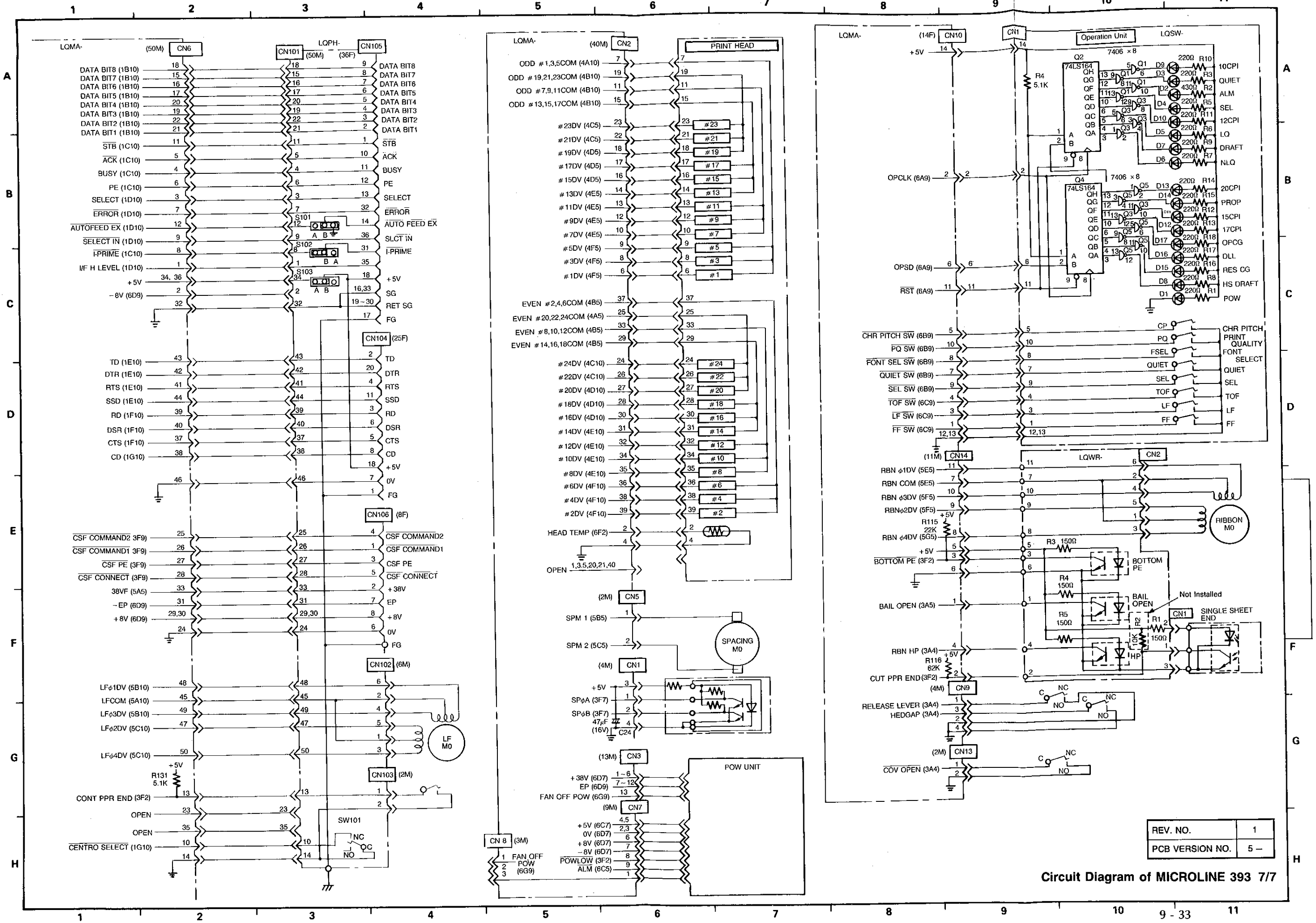






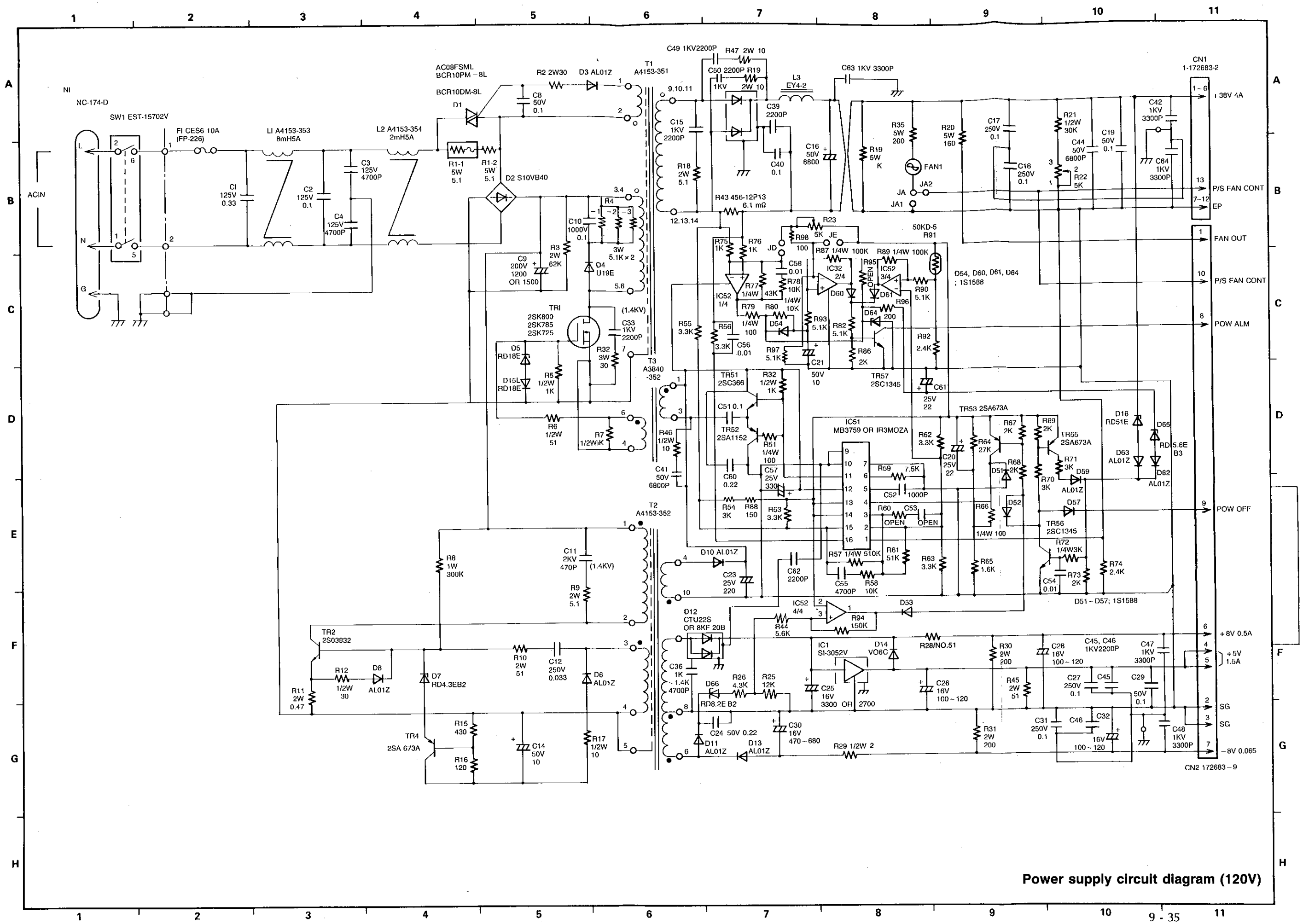
REV. NO.	1
PCB VERSION NO.	5 –

Circuit Diagram of MICROLINE 393 6/7

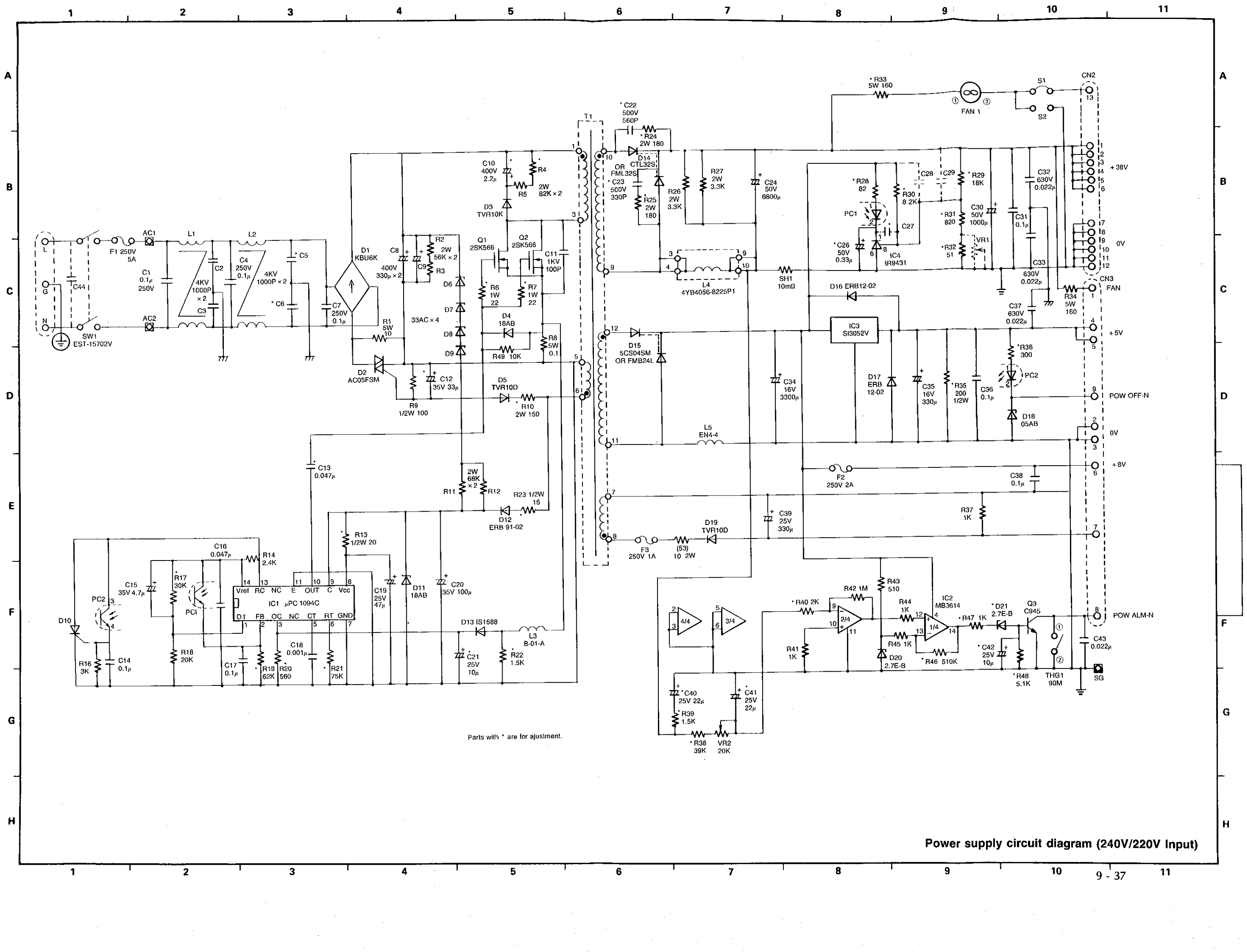


REV. NO.	1
PCB VERSION NO.	5 –

Circuit Diagram of MICROLINE 393 7/7

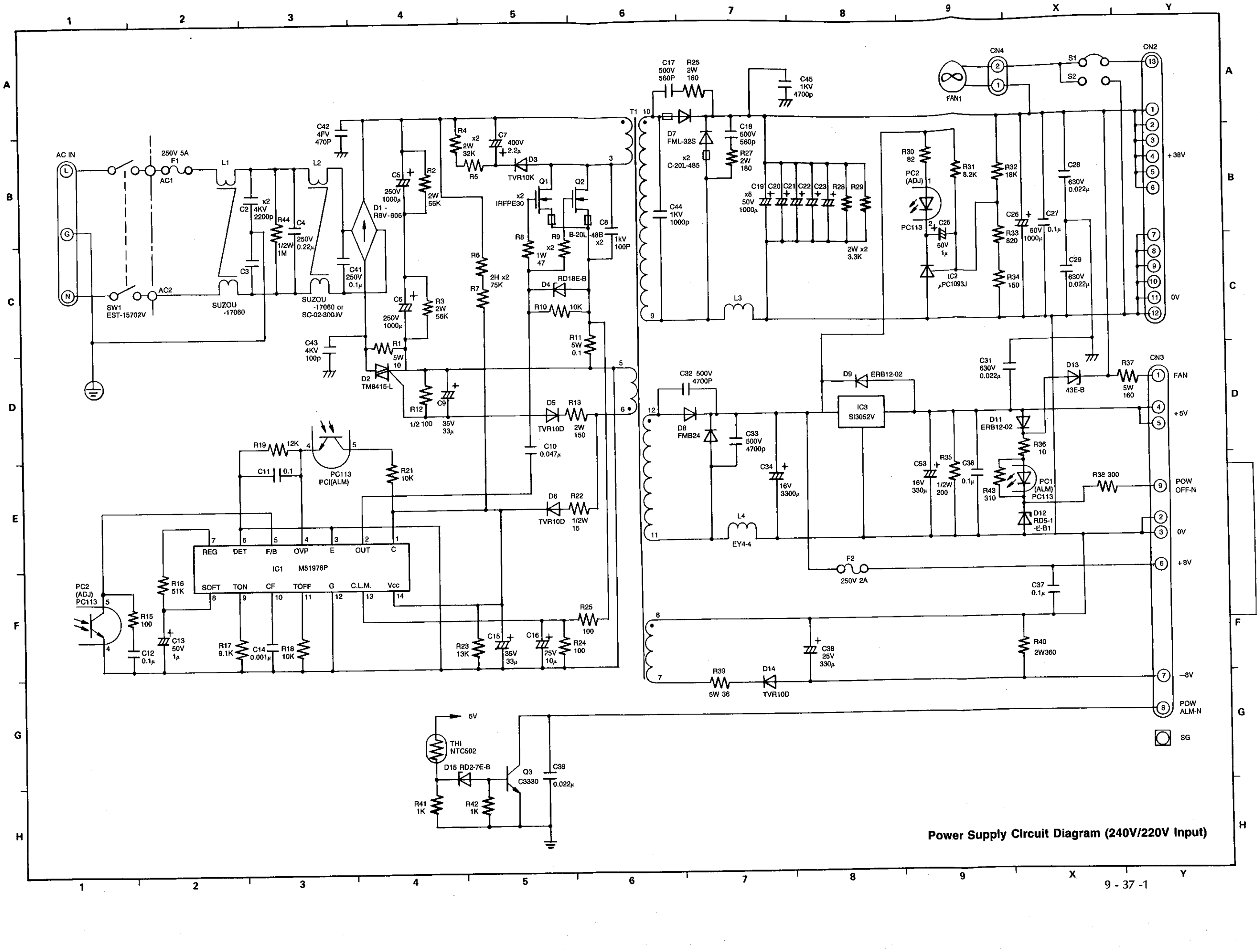


Power supply circuit diagram (120V)



Parts with * are for ajustment.

Power supply circuit diagram (240V/220V Input)



Power Supply Circuit Diagram (240V/220V Input)

10. ILLUSTRATED PARTS BREAKDOWN

10. ILLUSTRATED PARTS BREAKDOWN

Quantity per year: Indicates the recommended number of each part that should be ordered for routine maintenance for one year depending on the number of printers and assuming that the printers are operated for 2 hours/day of 600 hours/year. The following codes are used to indicate the number of printers for which maintenance parts are ordered.

Code	Number of Printers
A	Up to 100
B	Up to 500
C	Up to 3,000

Table of Parts Number 1/3

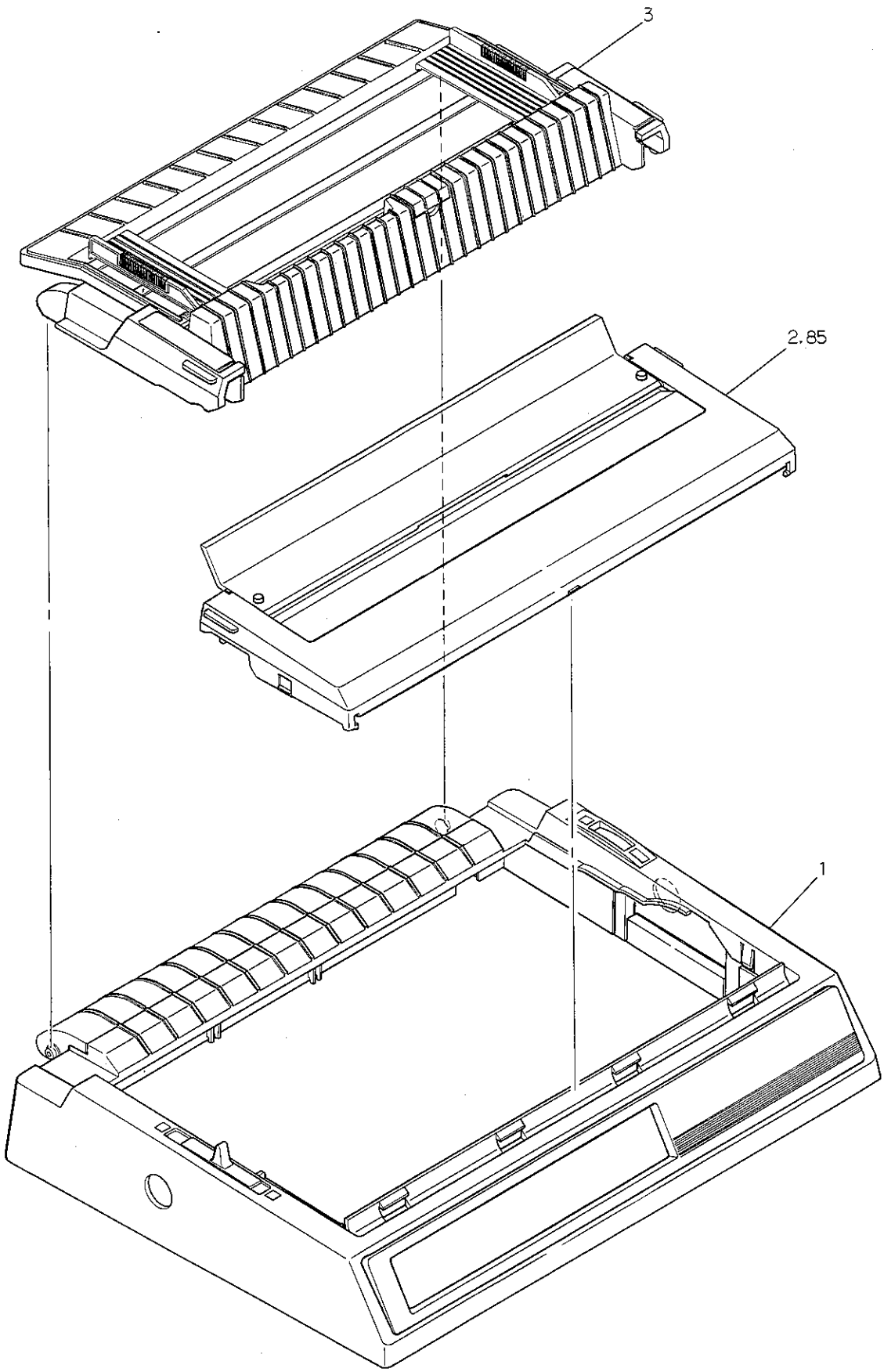
No.	Parts No.	Description	Q'ty per Printer	Q'ty per year		
				A	B	C
1	2PA4016-4723G1	Middle Cover Assy (ODA)	1	0	1	3
	2PA4016-4723G3	Middle Cover Assy (ODG)	1	0	1	3
2	2PA4016-6062G1	Access Cover Assy (ODA) (Monochrome model)	1	0	1	3
	2PA4016-4724G3	Access Cover Assy (ODG)	1	0	1	3
3	2PA4016-4725G1	Rear Cover Assy	1	0	1	3
4	4YA4023-1100G1	Printhead	1	3	10	20
5	3PP4043-2501P1	Platen Knob	2	2	5	10
6	4YA4042-1299G1	Operation Panel PCB (LQSW)	1	1	3	10
7	3PP4043-2712G1	Operation Panel	1	0	2	5
8	LP-5466-8	Card	1	1	3	5
9	4YA4042-1298G1	Sensor Board (LQWR)	1	1	3	5
10	4LB-192200-5	Spring (Cover Open Lever)	1	0	2	5
11	4YA4042-1292G11	Main PCB (LQMA)	1	2	5	10
12	4YA4042-1293G11	Interface Connector Assy (LQPH)	1	1	3	5
13	4YB4049-1277P2	Power Supply Assy (120V ODA)	1	2	5	10
14	4YB4049-1278P1	Power Supply Assy (220/240V ODA/ODG)	1	2	5	10
15	4YS4011-6295G1	Power Connection Cord (9P)	1	0	3	5
16	4YS4011-6253G3	Power Connection Cord (13P)	1	0	3	5
17	3YS4011-1026P1	AC Cable (USA Standard)	1	0	1	3
18	3YS4011-1172P1	AC Cable (Continental)	1	0	1	3
19	3YS4011-1173P1	AC Cable (British)	1	0	1	3
	3YS4011-1103P1	AC Cable (Australian)	1	0	1	3
20	3YX4043-2550G1	Space Motor Assy	1	1	3	5
21	3PB4043-2649P1	LF Motor Assy	1	1	3	5
22	4LP-1313-239	Mini Pitch Belt (LF)	1	0	3	5
23	4PA4043-2556G1	Platen Assy	1	0	1	3
24	3PP4043-2466P1	Platen Gear A	1	0	1	3
25	4PP4043-2465G1	Platen Pulley	1	0	1	3
26	3YX4043-2561G1	Push Tractor Assy (L)	1	0	1	3
27	3PA4043-2562G1	Push Tractor Assy (R)	1	0	2	5
28	4PP4043-2451P1	Friction Piece	1	0	1	3

Table of Parts Number 2/3

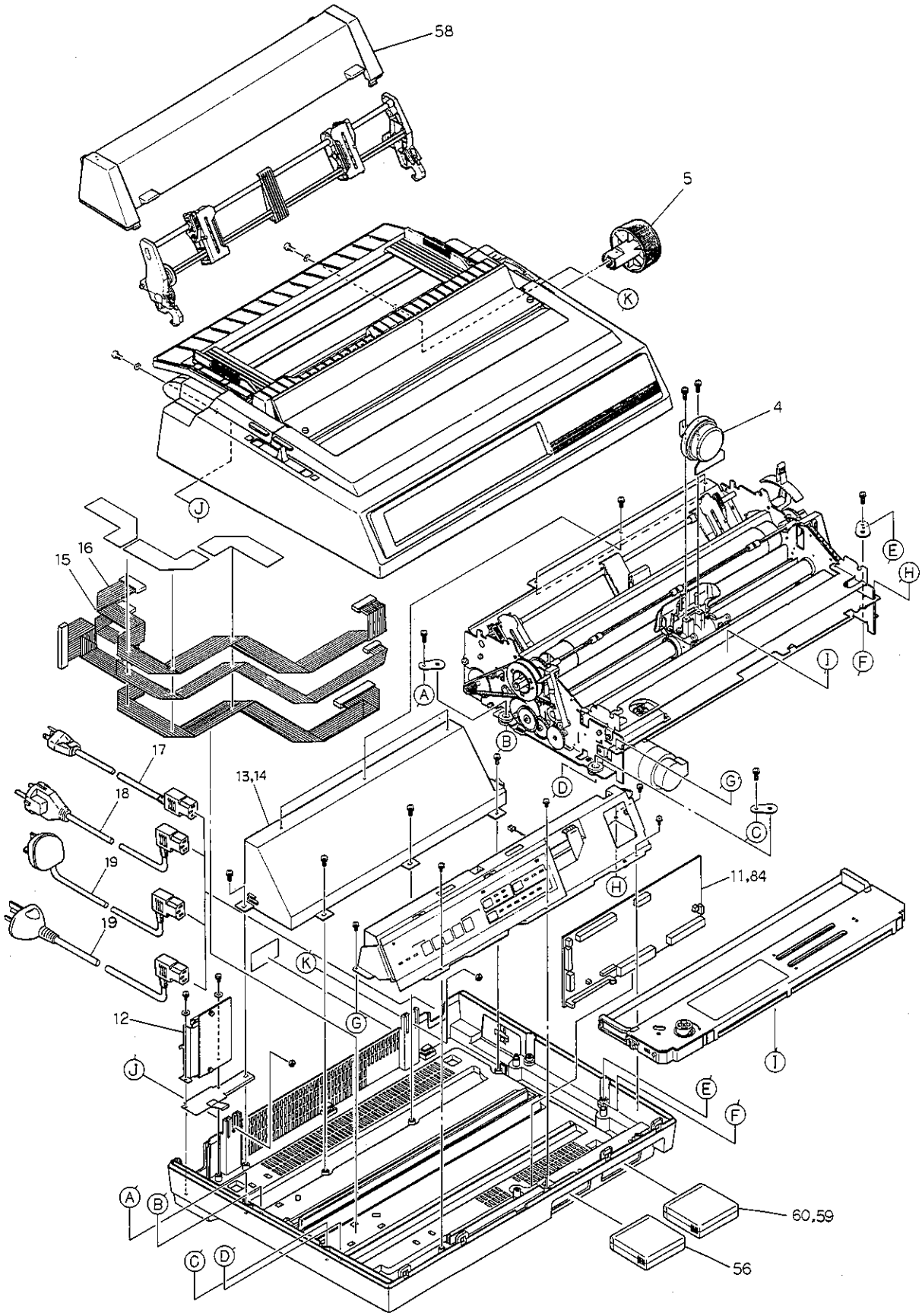
No.	Parts No.	Description	Q'ty per Printer	Q'ty per year		
				A	B	C
29	3PP4043-2452P1	Center Guide Upper	1	0	1	3
30	3PP4043-2453P1	Center Guide Lower A	1	0	1	3
31	3PP4043-2454P1	Center Guide Lower B	1	0	1	3
32	3YX4043-2759G1	Micro Switch Cable Assy (Cover Open)	1	0	1	3
33	4YX4043-2784G1	Micro Switch Cable Assy (Adjust & Release Lever)	1	0	1	3
34	4LB-193400-1	Spring (Paper Chute)	2	0	1	3
35	3PP4043-2459P1	Release Lever	1	0	1	3
36	4PP4043-2460P1	Release Lever Guide Block	1	0	1	3
37	4PB4043-2754P1	Detent Spring (for Release Lever)	1	0	1	3
38	4YX4043-2576G1	Sensor Assy (Cut Sheet)	1	1	3	5
39	4PP4043-2458P1	Idle Gear	1	0	1	3
40	4LB-190600-6	Spring (for Idle Gear)	1	0	1	3
41	4PP4043-2456P1	Drive Gear A	1	0	1	3
42	4PP4043-2457P1	Drive Gear B	1	0	1	3
43	4PA4043-2584G1	Ribbon Feed Assy	1	1	3	5
44	4PP4043-2628P1	Spring (Bail Arm) (L)	1	0	2	5
45	4LB-193100-2	Spring (Bail Arm) (R)	1	0	2	5
46	3PB4043-2601P1	Stepping Motor Assy (Bail/Ribbon Motor)	1	1	3	5
47	5LR-193134	Idle Gear	1	0	1	3
48	3PP4043-2504P1	Adjust Lever	1	0	1	3
49	4PA4043-2711G1	Indicator Shaft Assy	1	0	1	3
50	3PP4043-2509P1	Bail Arm (L)	1	0	1	3
51	3PP4043-2510P1	Bail Arm (R)	1	0	1	3
52	3PP4043-2764P1	Bail Open Cam	1	0	1	3
53	4PB4044-1492P3	Mini Pitch Belt (Spacing)	1	0	1	3
54	3YX4043-2713G1	Head Cable Assy	1	0	1	3
55	4PP4043-2643G1	Ribbon Guide	1	1	3	5
56	4YA4042-1300G101	Personality Module (ODA) EPSON	1	0	1	3
	4YA4042-1300G201	Personality Cartridge (ODG) EPSON	1	0	1	3
	4YA4042-1300G102	Personality Module (ODA) IBM/EPSON	1	0	1	3
	4YA4042-1300G202	Personality Cartridge (ODG) IBM	1	0	1	3

Table of Parts Number 3/3

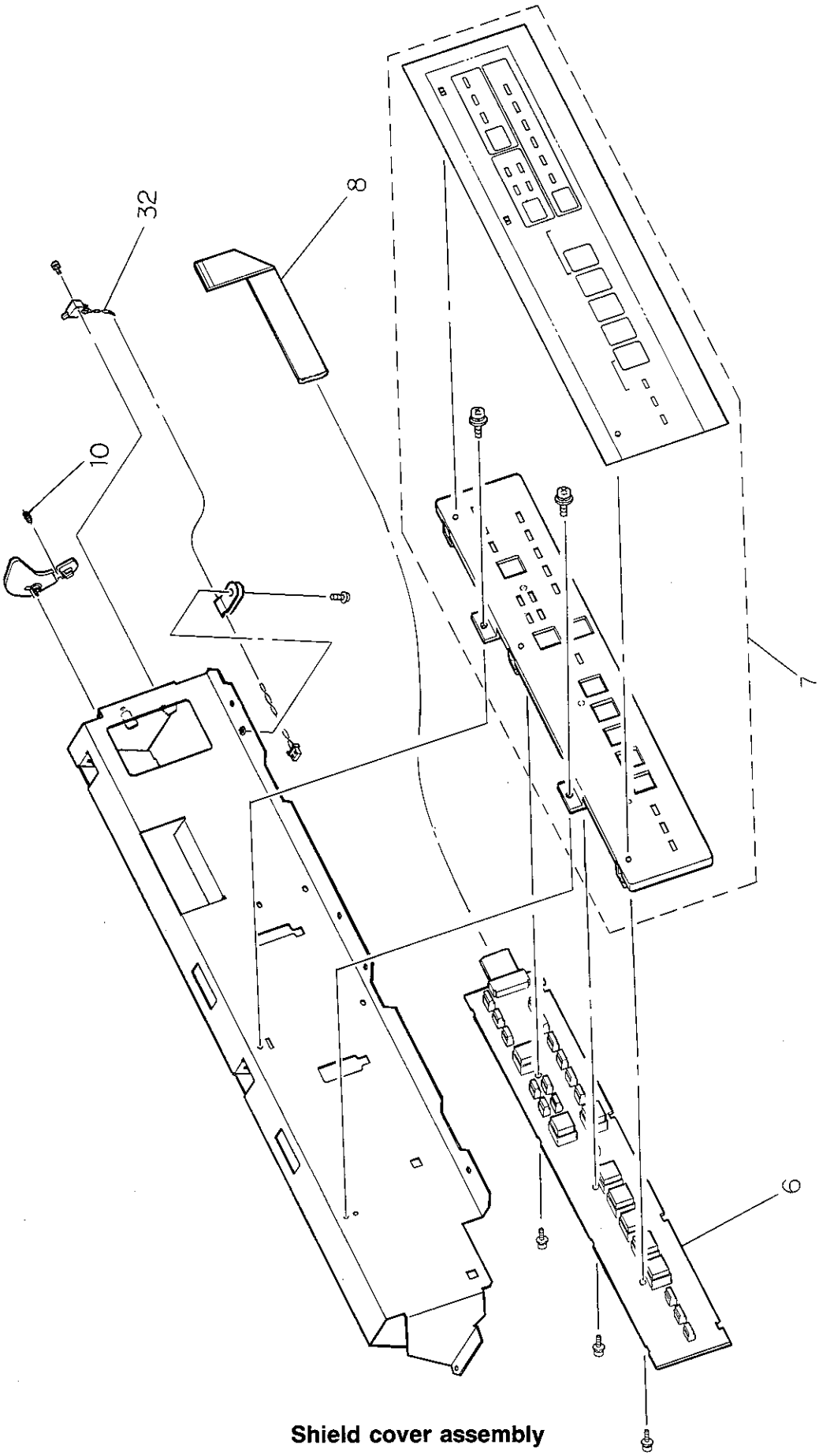
No.	Parts No.	Description	Q'ty per Printer	Q'ty per year		
				A	B	C
57	4PP4043-2613G1	Ribbon Protector	1	1	3	5
	(Option)					
58	2PA4016-4722G1	Tractor Cover Assy (Option)	1	0	0	1
59	4YA4042-1301G101	Font Cartridge (Option) GOTHIC (ODA)	1	0	1	3
	4YA4042-1301G201	Font Cartridge (Option) GOTHIC (ODG)	1	0	1	3
60	4YA4042-1301G102	Font Cartridge (Option) PRESTIGE (ODA)	1	0	1	3
	4YA4042-1301G202	Font Cartridge (Option) PRESTIGE (ODG)	1	0	1	3
	(COLOR VERSION ONLY)					
70	2PP4043-3325P1	Ribbon Shift Cam	1	0	1	3
71	4PP4043-2729P1	Ribbon Shift Gear	1	0	1	3
72	4PA4043-2710G1	Shift Cam Lever Assy	1	0	1	3
73	4PP4043-2776G1	Ribbon Shift Arm	1	0	1	3
74	4PP4043-2741G1	Roller Lever	1	0	1	3
75	4PP4043-2745P1	Screw	3	0	1	3
76	4LB-192400-11	Spring (Shift Arm)	1	1	3	5
77	4LB-130100-3A	Shoulder Screw (L)	1	0	1	3
78	4LB-130100-6A	Shoulder Screw (R)	1	0	1	3
79	3PP4043-2477P2	Ribbon Guide	1	1	3	5
80	4PP4043-2642P1	Cartridge Balance Spring	1	0	1	3
81	3PP4043-3321P1	Bail Open Cam	1	0	1	3
82	4PP4043-2499P1	Bail Open Gear	1	0	1	3
83	4YA4042-1298G2	Sensor Board (LQWR-2)	1	1	3	5
84	4YA4042-1292G12	Main PCB (LQMA-2)	1	2	5	10
85	2PA4016-6062G2	Access Cover Assy (ODA)	1	1	3	5
	2PA4016-4724G1	Access Cover Assy (ODG)	1	0	1	3
	(TRACTOR UNIT OPTION)					
90	4PA4043-2684G1	Pin Tractor Assy (L)	1	0	2	5
91	4PA4043-2685G1	Pin Tractor Assy (R)	1	0	2	5



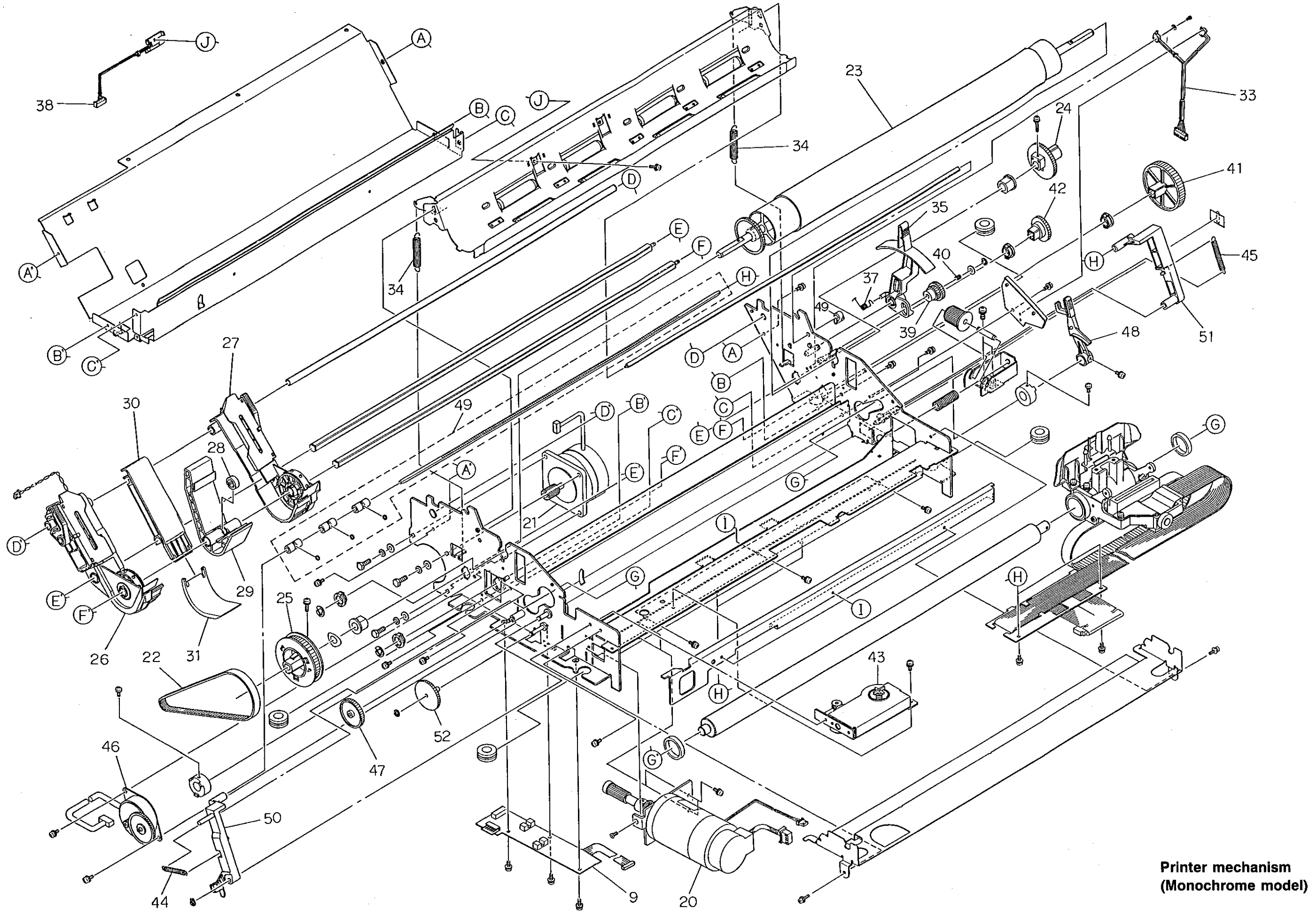
Upper cover assembly



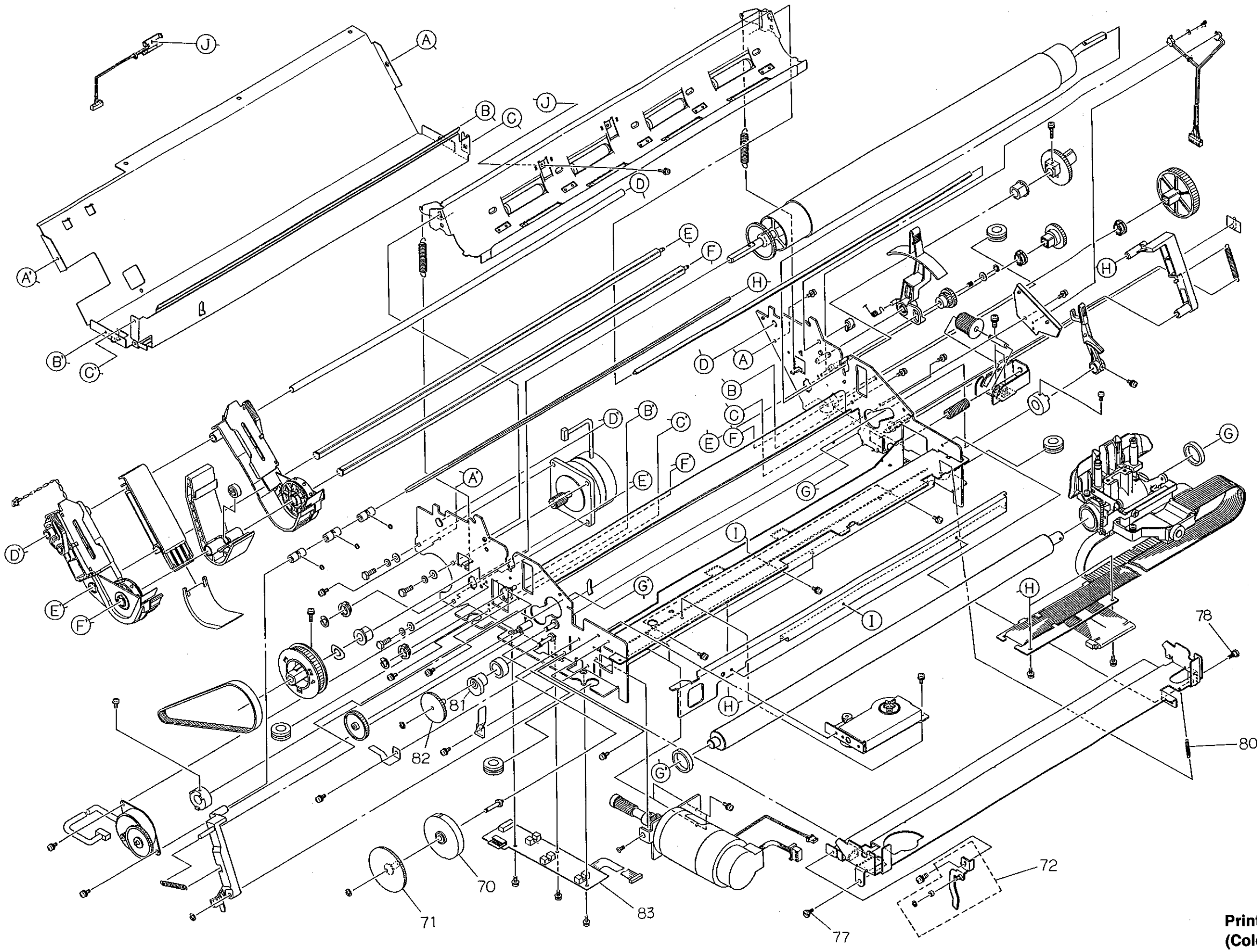
Printer unit general assembly



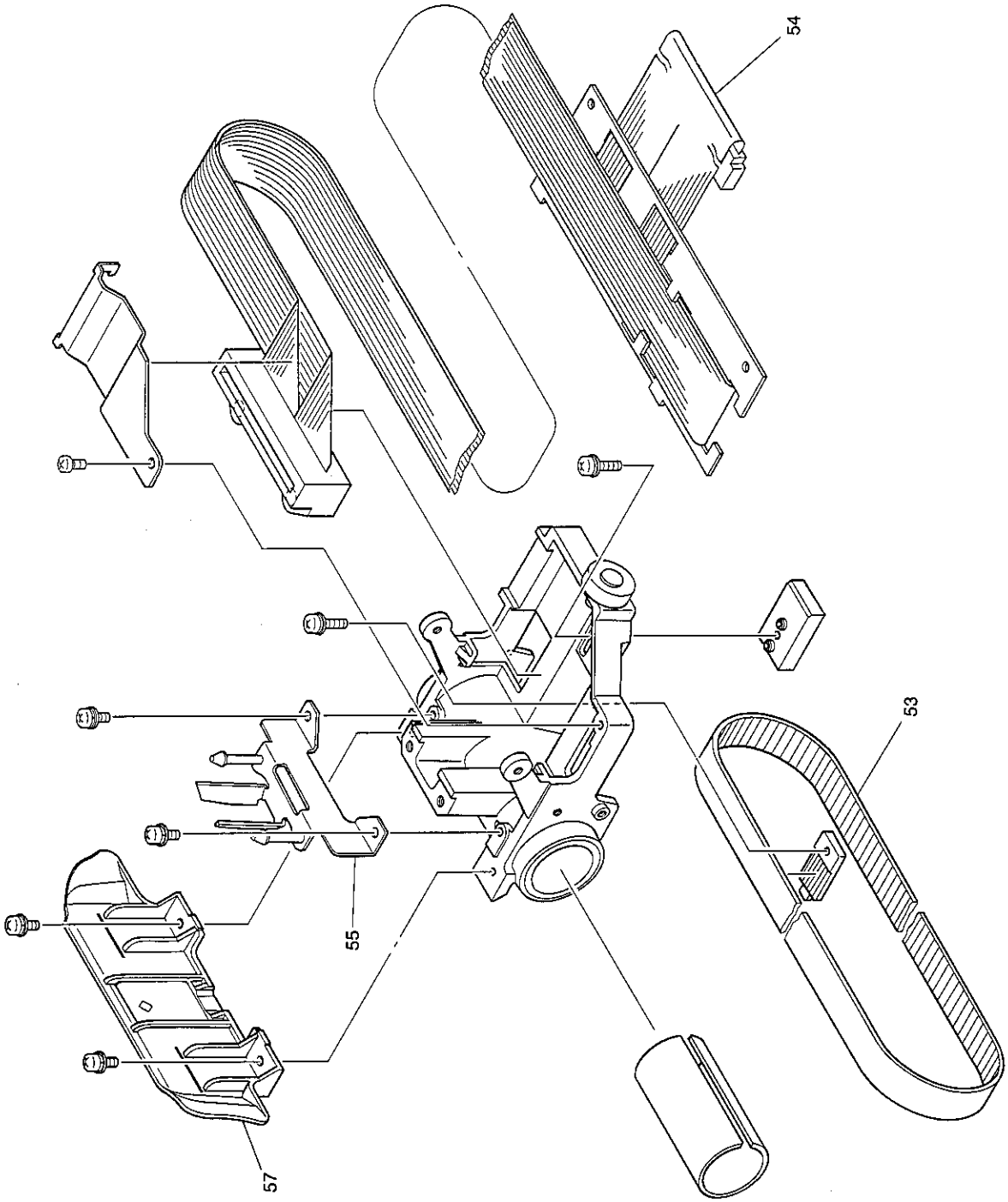
Shield cover assembly



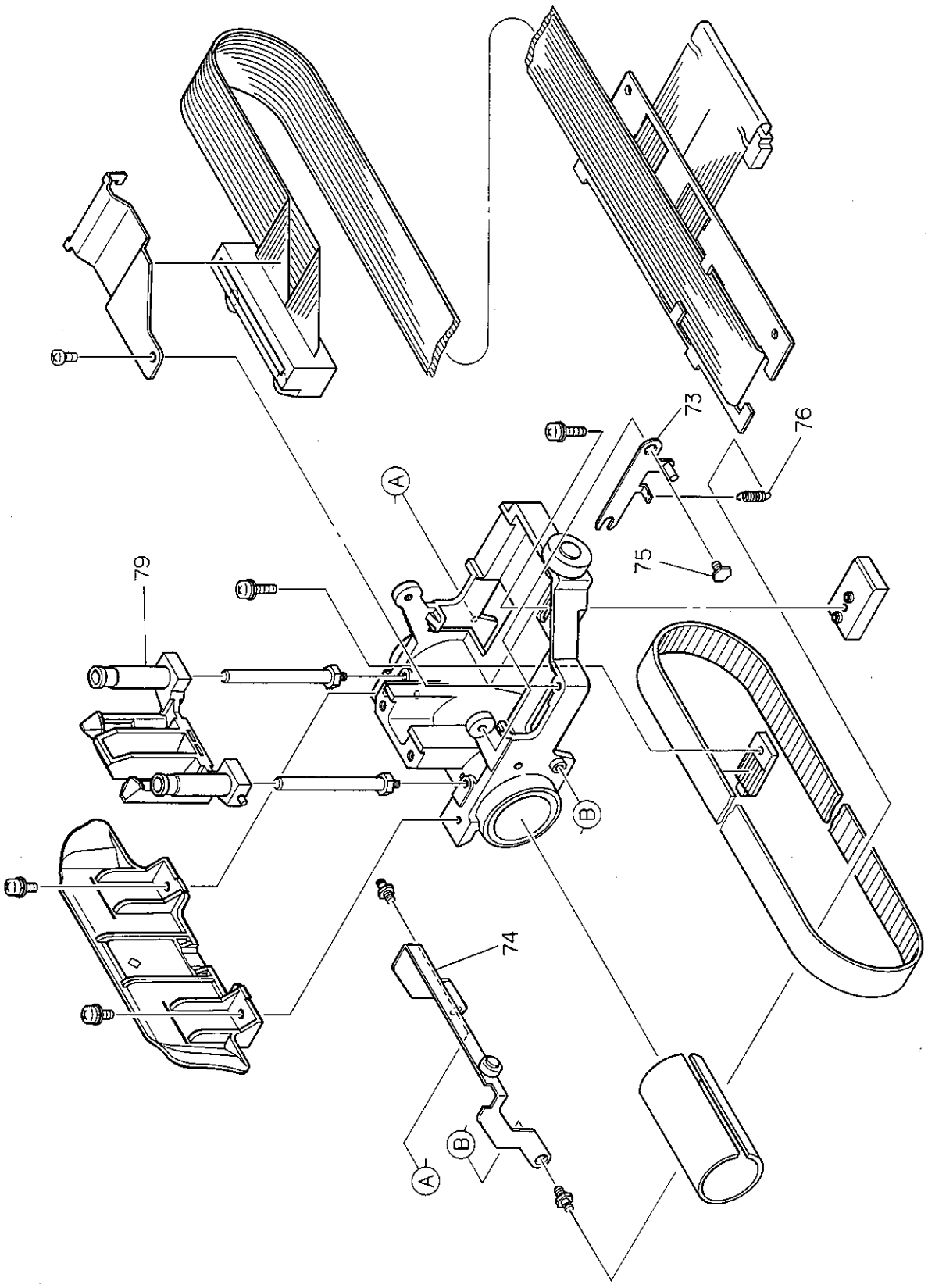
Printer mechanism (Monochrome model)



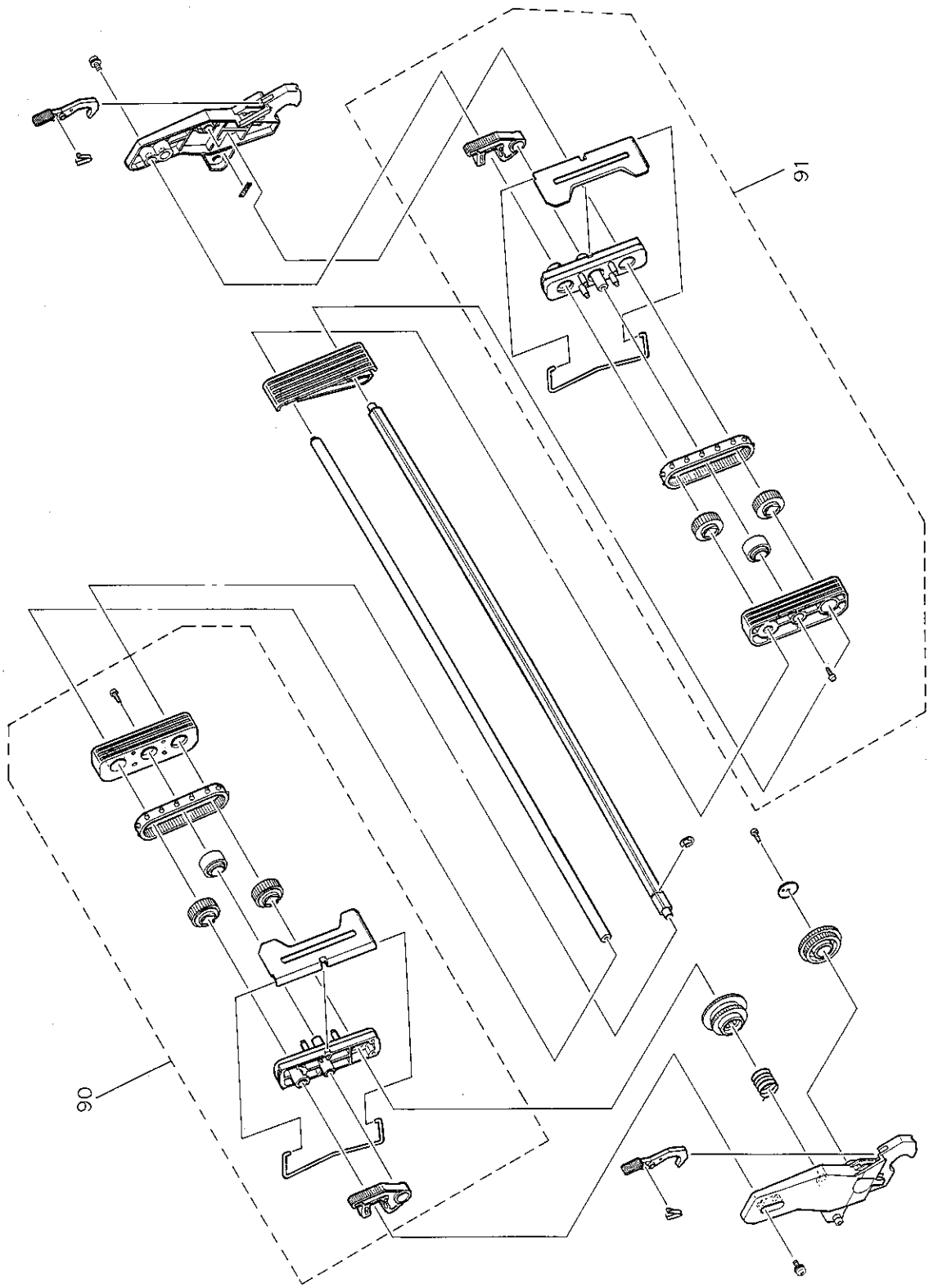
Printer mechansim (Color model)



Carriage assembly
(Monochrome model)



Carriage assembly
(Color model)



Tractor unit

APPENDIX

A. EXPLANATION OF OPERATION

1. GENERAL

This printer mainly consists of the printing mechanism unit, control unit and power supply unit. The printing mechanism unit consists of the print head, spacing mechanism, paper feed mechanism and ribbon change mechanism (in color model only).

The control unit is roughly divided into the main control board and personality cartridges.

Each of these components operates as described below.

1.1 Printing Mechanism

(1) Print head

The print head has 24 wire dot magnets for printing according to the dot pattern generated in the control unit.

(2) Spacing mechanism

A DC servo motor moves the carriage for spacing, tab and CR.

(3) Line feed mechanism

A stepping motor (LF motor) carries out line feeding operation and feeds the continuous paper or single sheets.

(4) Ribbon change mechanism (in color model only)

A stepping motor selects and changes the color ribbons.

(5) Bail open/close mechanism

A stepping motor opens/closes the bail.

1.2 Control Unit

(1) Main control board

Two microprocessors (MPUs) control the whole printer via the peripheral LSIs, memory and other circuits.

Interface circuits and various motor driver circuits are also mounted on this board.

(2) Personality module

The printer control program ROM and resident character font ROM are the mounted module. The control unit controls the printer according to the stored program.

(3) Power supply unit

The power supply unit converts the AC input to +5 VDC, +38 VDC and ±8 VDC.

Figure 1.1 shows the block diagram of this printer.

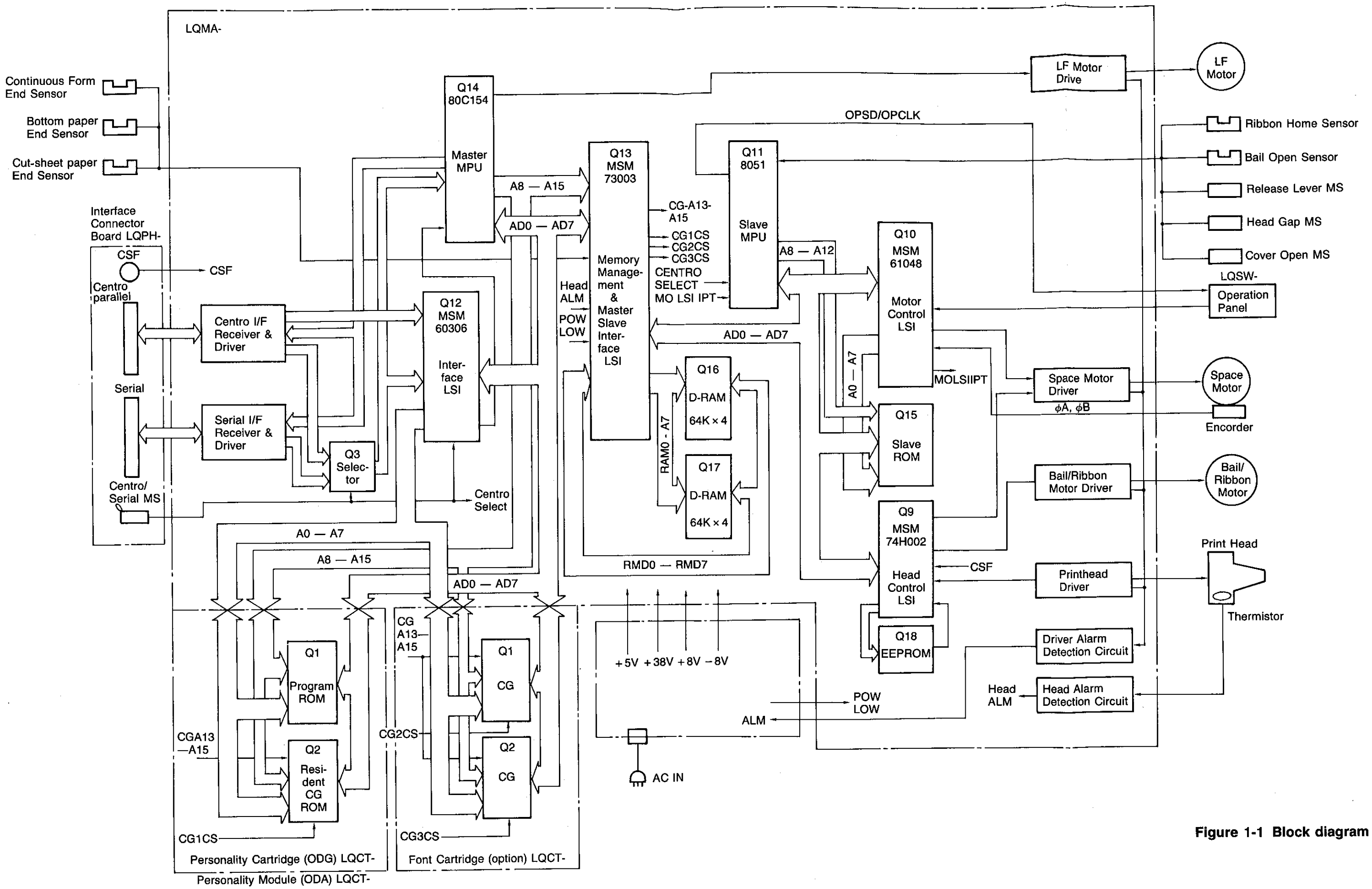


Figure 1-1 Block diagram

2. CIRCUIT DESCRIPTION

2.1 MPUs and Peripheral Circuits

2.1.1 Main Control Board

(1) Micro processors (Q14: 80C154 and Q11: 8051)

Microprocessors (MPUs) are the core of the control circuit. Peripheral circuits operate according to the instructions from the MPUs.

Two MPUs are adopted in increase the processing speed of the printer.

The master MPU (Q14) mainly controls the interfaces, code processing and commands to the slave MPU, while the slave MPU (Q11) mainly controls the spacing operation and print timing.

(2) Program ROM of slave MPU (Q15: 2764)

This ROM stores the slave MPU control program.

The slave MPU executes various processings according to the program and the commands from the master MPU.

(3) Dynamic RAMs (Q16 and Q17)

These dynamic RAMs Q16 and Q17, each consisting of 64 K bits × 4 bits, are used as a pair as the receiving data buffer and print buffer, for a total of 64 K × 8 bits.

(4) EEPROM (Q18)

This 256-bits serial electrically erasable and programmable ROM stores the menu data.

(5) Interface LSI (Q12: MSM60306)

The MSM60306 is an external interface LSI and has the following functions:

(a) Interface control

This LSI is used as the control, input and output ports for the parallel and serial interface data and various interface signals.

The input signal to pin 4 (RS/Centro) of the LSI enables selection between the parallel and serial interface modes.

(b) Address latch

This LSI latches the lower 8 bits (A_0 — A_7) of the address on the master MPU and uses it as the address for read/write from and to peripheral devices.

(6) LSI (Q13: MSM73003)

This LSI is connected to the MPU80C154 and 8051, and has the following functions:

(a) Master-slave MPU interface (DMA control) function

This LSI transfers commands and data to the slave MPU by using the DMA (direct memory access) method according to the commands from the master MPU.

This LSI carries out transfer from the DRAMs to the slave MPU via the internal data FIFO in units of max. 252 bytes according to the DMA transfer start address, number of bytes to be transferred, transfer direction and command/data selection information set by the master MPU.

The answers to the commands from the master MPU to the slave MPU are returned from the slave MPU to the master MPU via the 2-byte answer FIFO in the LSI.

(b) Memory space expansion function

This function enables the MPU data memory space to be expanded up to 320 K bytes consisting of 5 banks.

(c) DRAM interface

This LSI outputs the DRAM address (RMA0 — RMA7) according to the master address or DMA address, and carries out data write/read to and from DRAMs according to the RAS, CAS and RRD signals.

(d) DRAM refresh

This LSI refreshes DRAMs by using the CAS before RAS refresh method.

(7) LSI (Q10: MSM61048)

This LSI for motor control has the following functions:

(a) Space motor speed control

This LSI accelerates and decelerates the space motor according to the input commands from the slave MPU. It also controls the space motor speed in each printing mode.

(b) Dot ON timing generation

This LSI generates the dot ON timing (MO LSI IPT) in synchronism with the printing mode according to the output (phase A or B) of the encoder built in the space motor and sends the information to the slave MPU.

(c) I/O port

This LSI has a 12-bit output port and a 10-bit input port. It outputs various control signals according to the input commands from the slave MPU.

It also reads operation panel switch information from the input port.

(d) Address latch

This LSI latches the lower 8 bits (A_0 — A_7) of the address on the slave MPU, and uses them as the address for read/write from and to peripheral devices.

(8) LSI (Q9: MSM74H002)

This LSI controls the 24-pin stagger print head under the control of the slave MPU, and has the following functions:

(a) Stagger print head control

This LSI distributes the dot data for one column consisting of 24 dots into odd and even sides. Depending on the printing direction, it first outputs the data on the leading side in synchronism with the MO LSI IPT signal. The data on the trailing side passes the internal FIFO buffer where it is delayed by the number of columns corresponding to the distance between the odd and even pins in the print head. The LSI outputs the overdrive signals (ODVC, ODVS, EDVC and EDVS) at the same time.

(b) Drive correction

This LSI determines the magnet drive time with the following corrections when outputting the above signals.

- Correction for edge pin driving
- Correction for the number of pins driven at the same time
- Correction for voltage fluctuation
- Correction for head gap
- Correction for the driving time difference between odd and even pins

(c) Stepping motor control

This LSI outputs the stepping motor (bail/ribbon motor) drive signal according to the command from the MPU.

(d) DC motor polarity selection control

This LSI outputs the SPMOFOW and SPMOREV signals for changing the rotation of space motor.

2.1.2 Personality cartridge

(1) Program ROM

The control program for the master MPU is stored in this memory. The master MPU executes various controls by using this program.

(2) CG ROM

The following character fonts are stored as the standard fonts:

(a) HIGH-SPEED DRAFT
(b) DRAFT
(c) NLQ
(d) LQ
(e) PROPORTIONAL

2.1.3 Font cartridge (Option)

The two following types of character fonts are stored:

(1) Prestige

LQ or NLQ mode prestige can be printed.
10, 12, 15, 17.1, 20 CPI

(2) Gothic

LQ or NLQ mode prestige can be printed.
10, 12, 15, 17.1, 20 CPI

2.2 Other Circuits

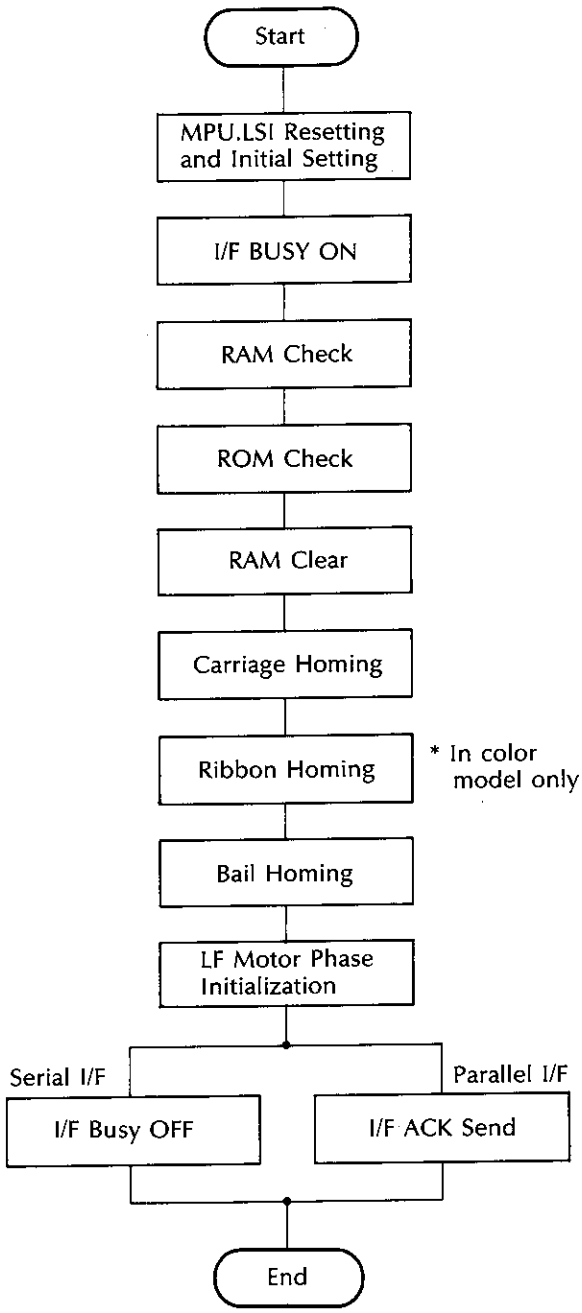
2.2.1 Initialize

This printer is initialized when the power is turned on or when the I-PRIME signal is input from the host side via the parallel interface.

For the initialize operation, the RST signal is first output from the reset circuit to reset the MPUs and LSIs. When resetting ends, the program starts.

The program here sets the mode of the LSIs (Q9, Q10, Q12 and Q13) including the MPUs (Q11 and Q14), checks the memories (ROMs and RAMS), then carries out carriage homing, bail arm homing, ribbon homing (in color model only), and determines the LF motor phase.

Finally, the program establishes the interface signals (P-I/F: ACK signal sending, and S-I/F: BUSY signal off) and lights the SELECT lamp to inform the ready state for receiving to the host side to end the initialize operation.



2.2.2 Interface control

The ML393 is provided with the centronics parallel interface and RS232-C serial interface as the standard features. The interface cable can be connected by selecting one of these interfaces. Changing the position of the connector cover of the interface connector assembly turns on or off the microswitch to inform the interface LSI of the interface to be selected. This signal sets the interface LSI to either the parallel or the serial mode.

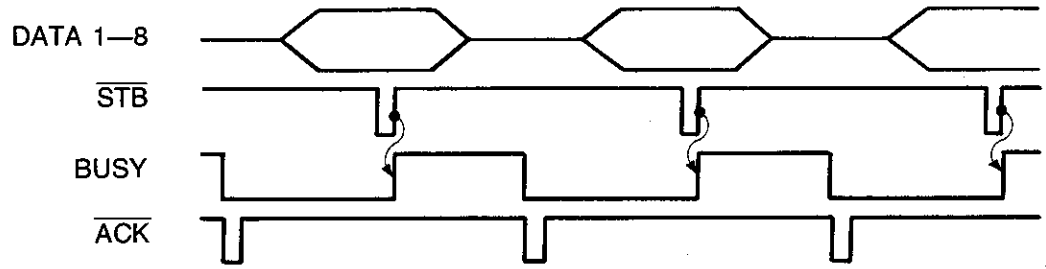
(1) Centronics parallel interface

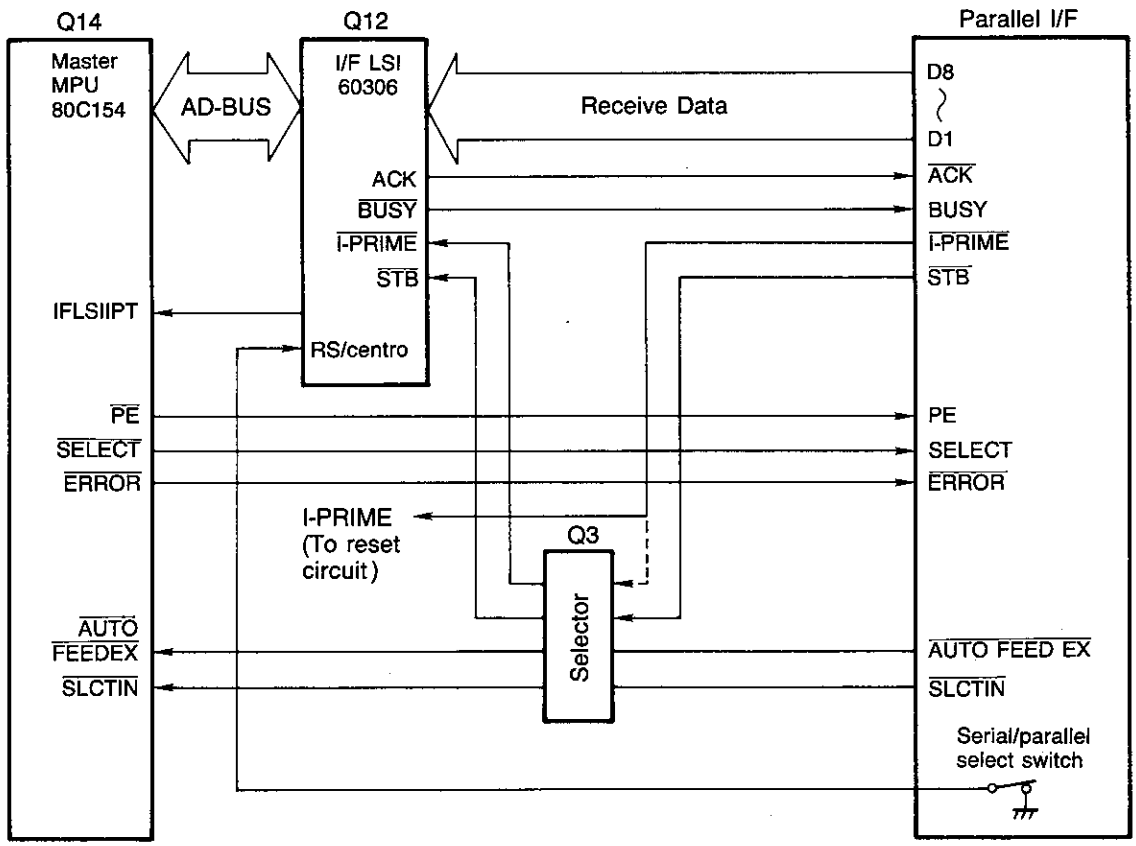
When the microswitch of the interface connector assembly is turned off, the $\overline{\text{CENTRO SELECT}}$ signal goes to the low level to set the interface LSI (Q12: MSM60306) to the parallel interface mode.

The parallel data input from the host to the interface LSI is latched to the internal register in the LSI at the rising edge of the $\overline{\text{STB}}$ signal.

At the same time, the LSI sets the $\overline{\text{BUSY}}$ signal to the low level to inform the host that the data is being processed, and outputs the $\overline{\text{IF LSI IPT}}$ signal to inform the master MPU of data reception. The data is read upon receiving the $\overline{\text{RD}}$ signal from the master MPU.

When the data processing ends, the BUSY signal is set to off and the $\overline{\text{ACK}}$ signal is sent to request the next data. When reception is impossible because the buffer is full, the BUSY signal is sent to request stopping of data transmission.



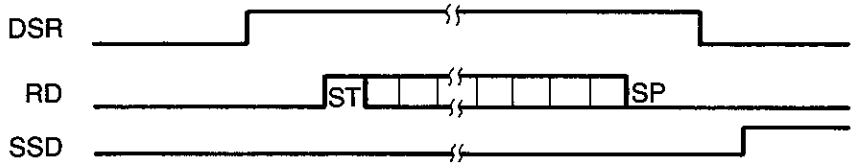


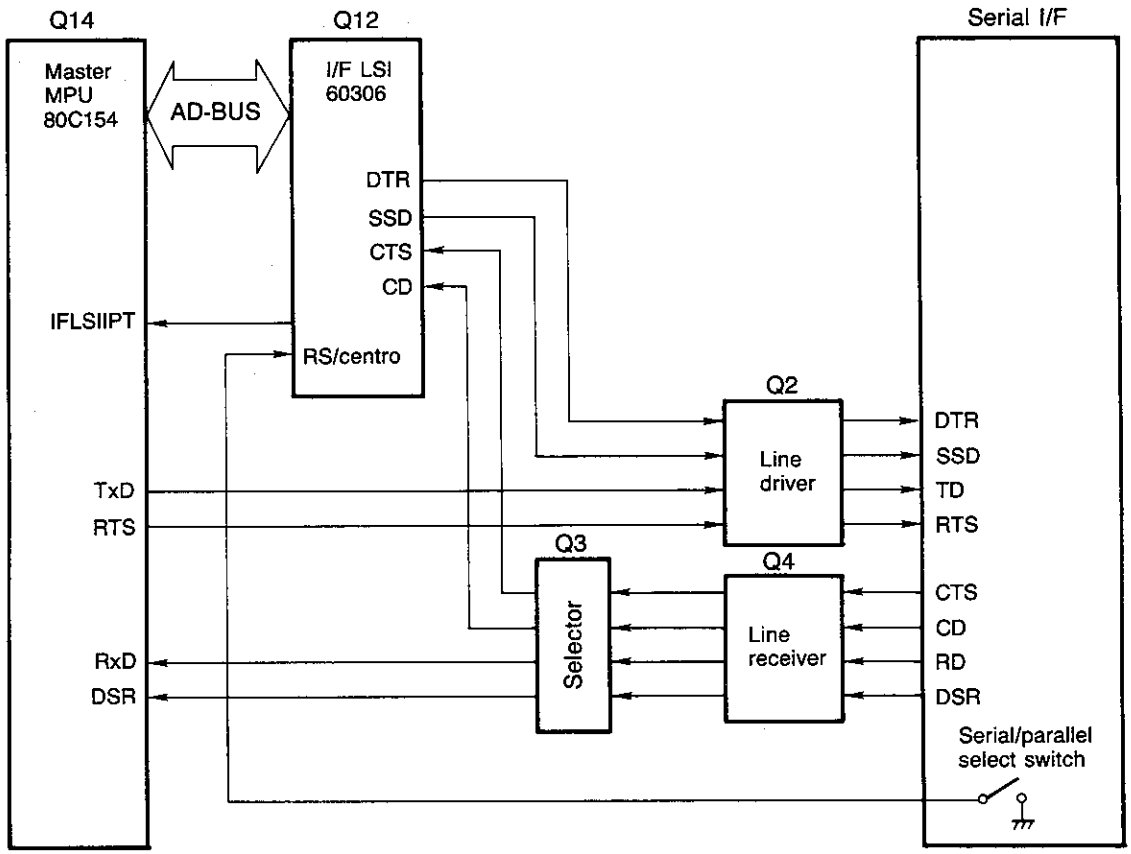
(2) RS232-C serial interface

When the microswitch of the interface connector assembly is turned ON, the $\overline{\text{CENTRO SELECT}}$ signal goes to the high level to set the interface LSI (Q12) to the serial interface mode.

RS232-C interface signals (DSR, CTS, CD and RD) are converted to the TTL level by the line receiver IC (Q4) and input to the interface LSI and master MPU via the selector IC (Q3). The serial data input to the serial port (pin 10) of the master MPU is converted to parallel data by the master MPU.

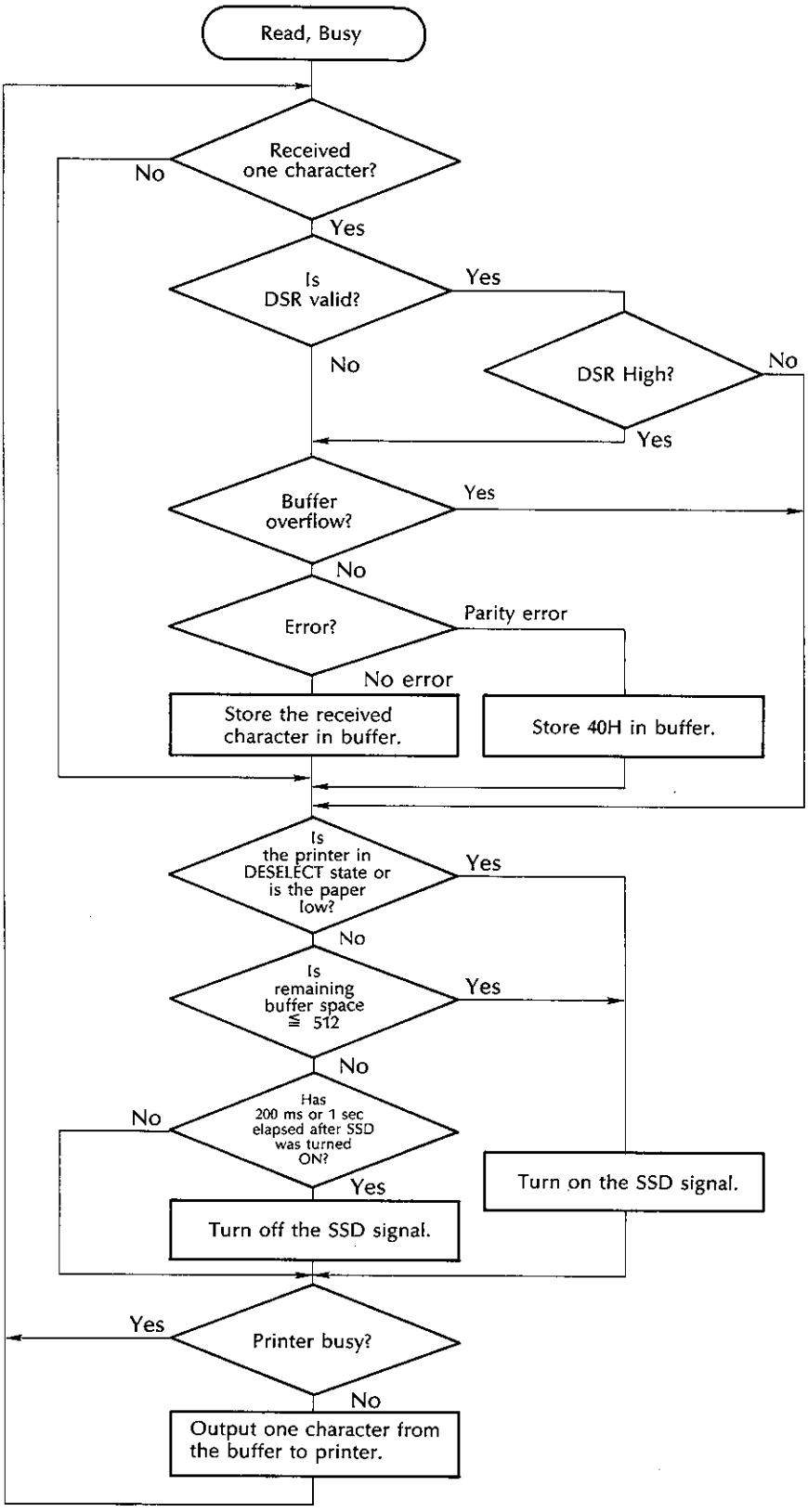
On the other hand, interface signals (DTR, RTS, SSD and TD) output from the master MPU and interface LSI are converted to the RS232-C line voltage by the line driver (Q2) and sent to the serial interface.



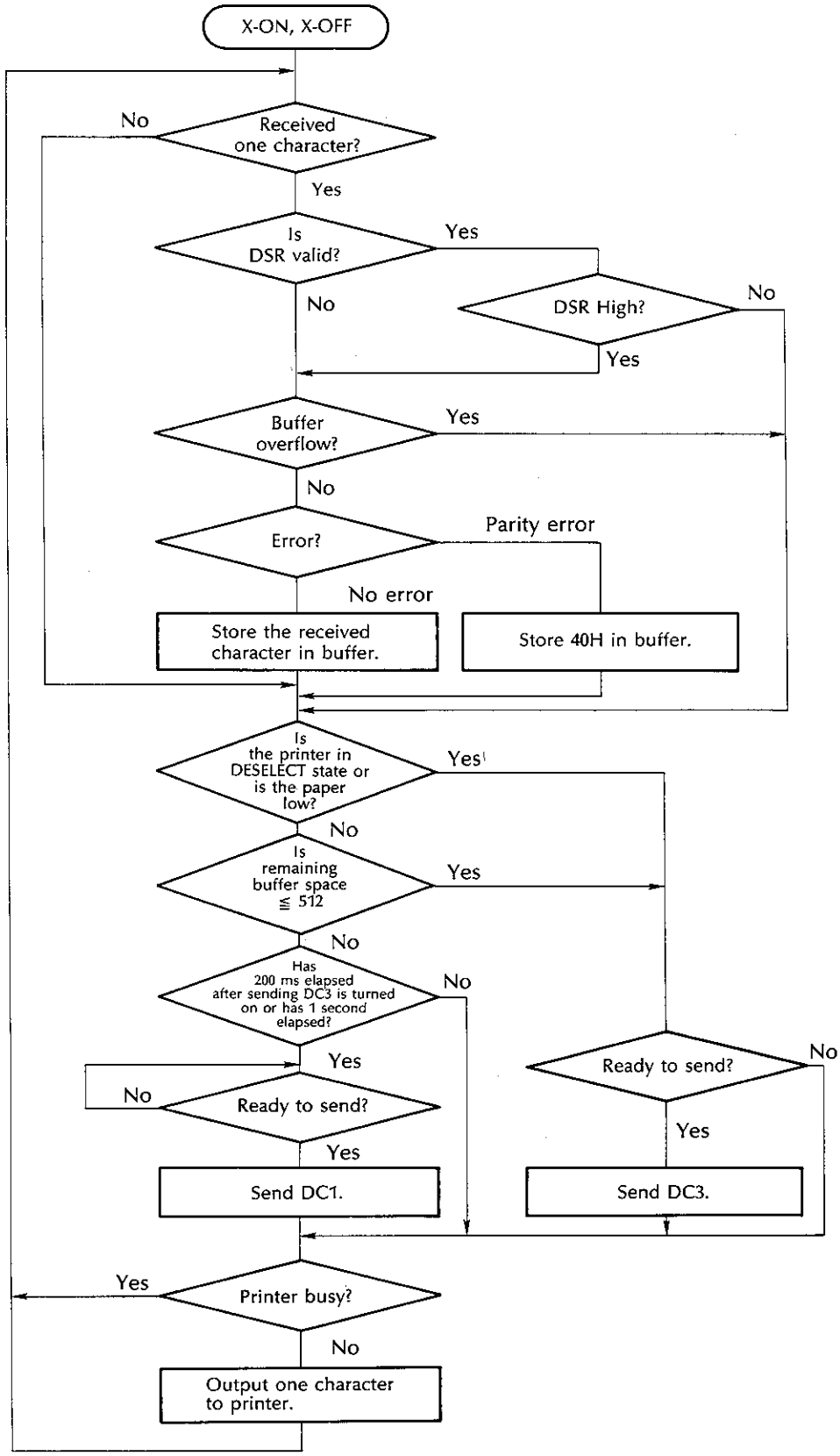


2.2.3 Communication procedure flow charts

(1) Ready/busy protocol



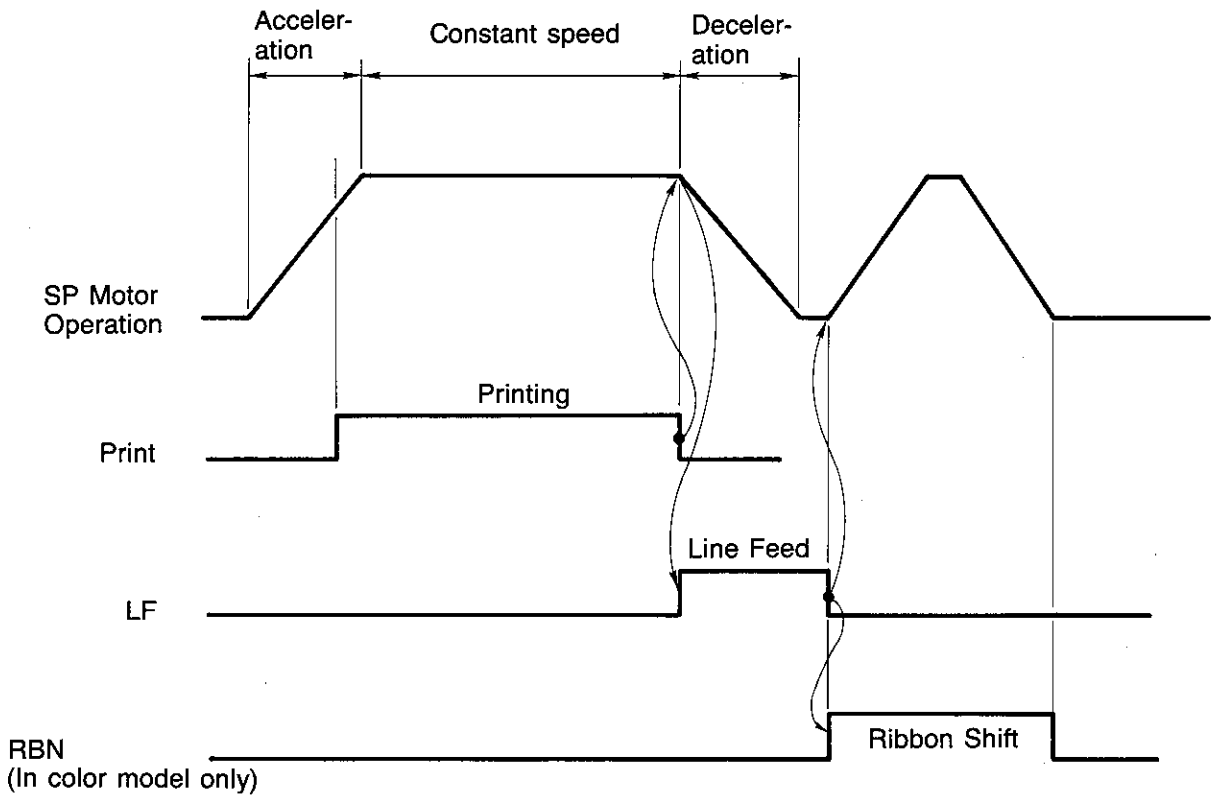
(2) X-ON/X-OFF protocol



2.2.4 Printing operation

The time chart for the spacing, printing, line feed, and ribbon shift operations is as shown below.

The spacing, printing, and ribbon shift operations are controlled by the slave MPU (8051) which receives commands from the master MPU (80C154). The line feed operation is controlled by the master MPU. The master MPU also controls the entire timing of these operations.



When starting the printing operation, the master MPU specifies the distance moved, print start position, printing speed, etc. to the slave MPU, and activates the spacing motor. The slave MPU, when the carriage arrives at the print position specified by the master MPU, activates the printer to start printing, and when printing terminates, it returns the print end signal to the master MPU. Upon receiving the print end signal, the master MPU activates the line feed motor for line feed operation. During the line feed operation, the slave MPU causes the carriage to decelerate. Upon termination of line feed operation in color model, the master MPU sends the ribbon shift and spacing commands to the slave MPU so that the spacing operation is performed and ribbon can be taken up during the ribbon shift operation.

2.2.5 Print head control

The print head is controlled by the head control LSI (Q9: MSM74H002).

Printing is synchronized with the $\overline{\text{IPT IN}}$ signal from the motor control LSI (Q10).

The head control LSI (Q9) outputs the dot signals (D1 — D24) and overdrive signals (EDVS, EDVC, ODVS and ODVC), and the hybrid driver IC drives each dot magnet. These signals are output from the head control LSI after the following corrections for final driving time determination inside the LSI:

① **Edge pin correction**

The driving time is increased for 6 pins each at the top and bottom.

② **Correction for the number of pins driven**

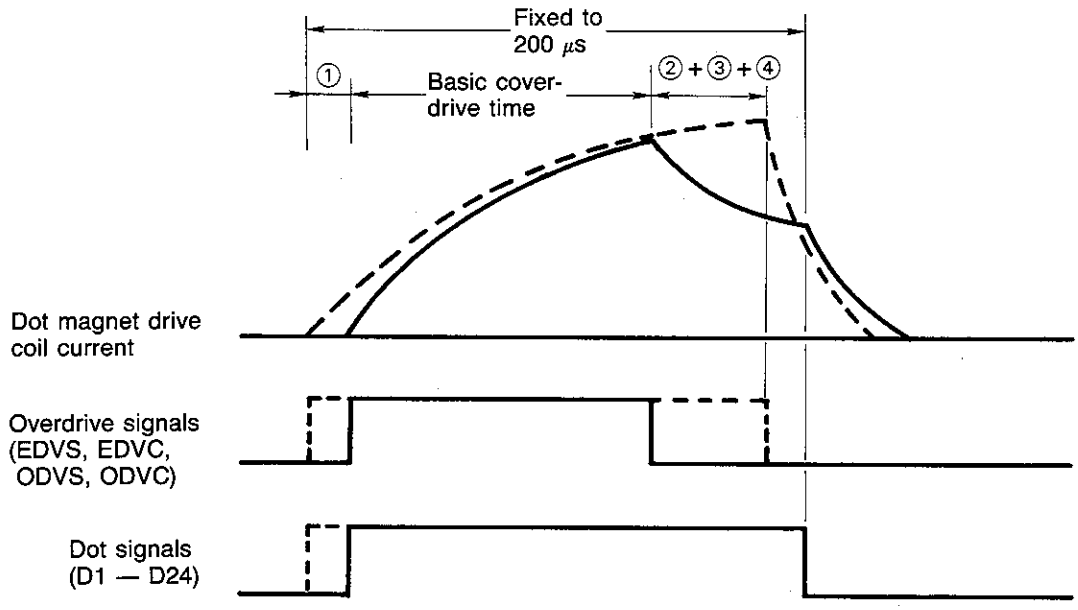
The driving time is corrected according to the number of pins driven at the same time out of 24 pins.

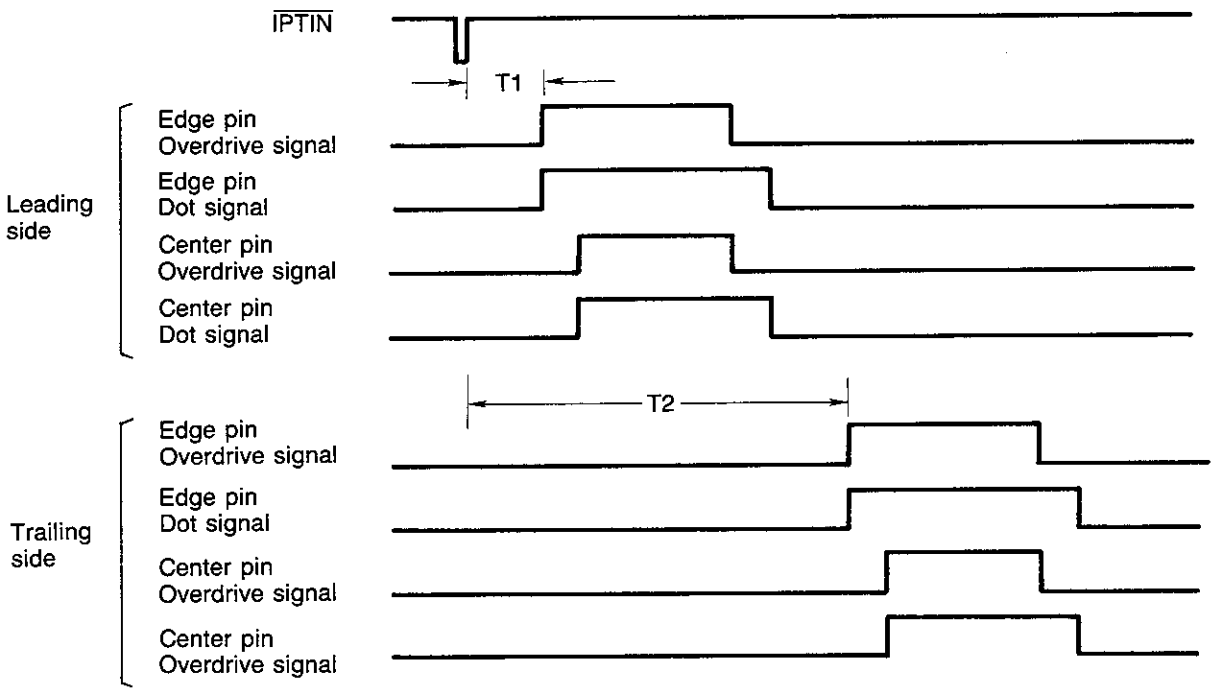
③ **Correction for voltage fluctuation**

The driving time is corrected according to the fluctuation of the drive voltage (+38 V).

④ **Correction for head gap**

The driving time is corrected according to the head gap.





T1: Drive OFF time
T2: Odd/even pin drive time difference*

* Equals T1, except for 8-pin 60/80/90 DPI printing and 24-pin 60/90/180 DPI printing. (Simultaneous driving of odd and even pins.)

- Edge pins are six pins each at the top and bottom requiring edge pin correction.
- Center pins are twelve pins at the center which do not require edge pin correction.

Signals in the above timing diagram correspond to the following signal names in the circuit diagram.

Forward print (Odd pin leading)

		Overdrive signal	Dot signal
Leading	Edge pin	ODVS	D1, D3, D5, D19, D21, D23
	Center pin	ODVC	D7, D9, D11, D13, D15, D17
Trailing	Edge pin	EDVS	D2, D4, D8, D20, D22, D24
	Center pin	EDVC	D8, D10, D12, D14, D16, D18

Reverse print (Even pin leading)

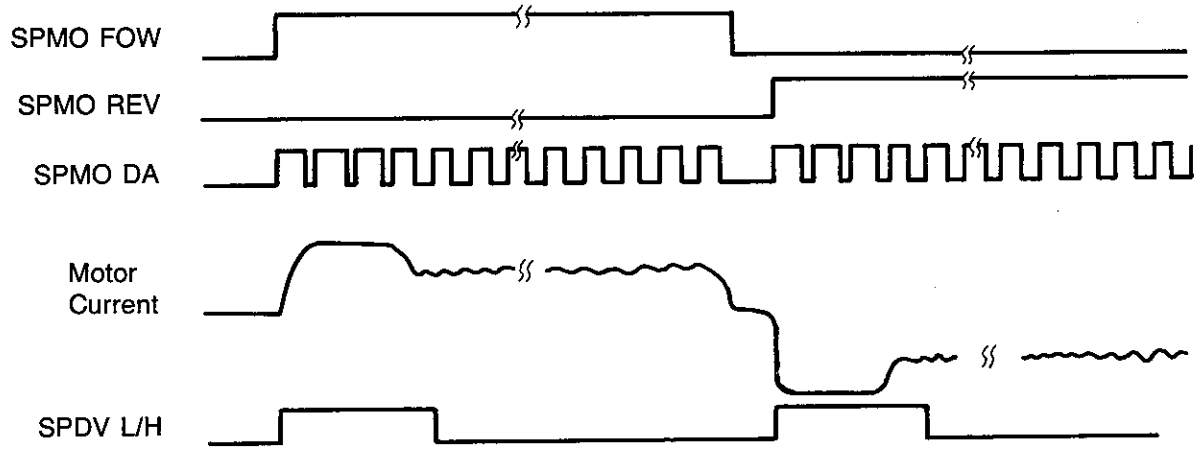
		Overdrive signal	Dot signal
Leading	Edge pin	EDVS	D2, D4, D6, D20, D22, D24
	Center pin	EDVC	D8, D10, D12, D14, D16, D18
Trailing	Edge pin	ODVS	D1, D3, D5, D19, D21, D23
	Center pin	ODVC	D7, D9, D11, D13, D15, D17

2.2.6 Space motor control

(1) The motor control LSI (Q10) outputs the SPMO DA signal upon receiving the spacing command from the slave MPU (Q11). This is a fixed cycle pulse signal.

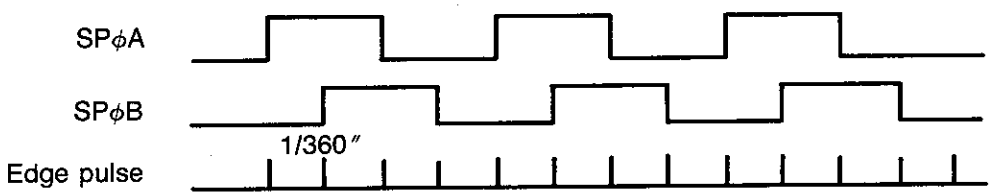
The motor control LSI varies the pulse duty according to the speed data from the slave MPU to control the motor speed.

The SPMO FOW or SPMO REV signal from the head control LSI (Q9) changes the current direction in the DC motor to run the motor in the forward or reverse direction.



(2) **Slit encoder**

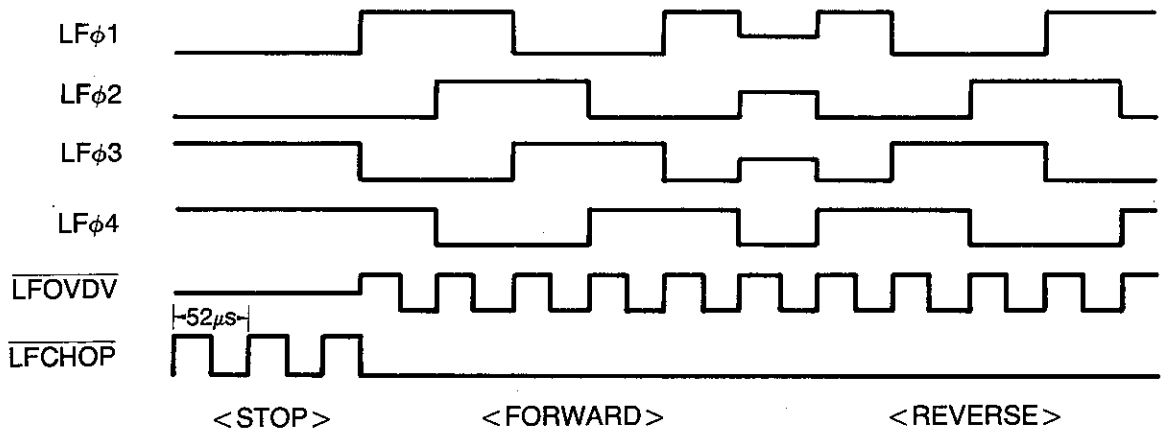
As the space motor rotates, it generates feedback pulse signals SPϕA and SPϕB. The motor control LSI detects the edge pulses from these signals and demultiplies the frequency to output the MO LSI IPT signals as the dot timing and the carriage position detection timing.



2.2.7 Line feed

The LF motor is locked by the current supplied from +8 V according to the pulse duty of the $\overline{\text{LF CHOP}}$ signal during the stop period.

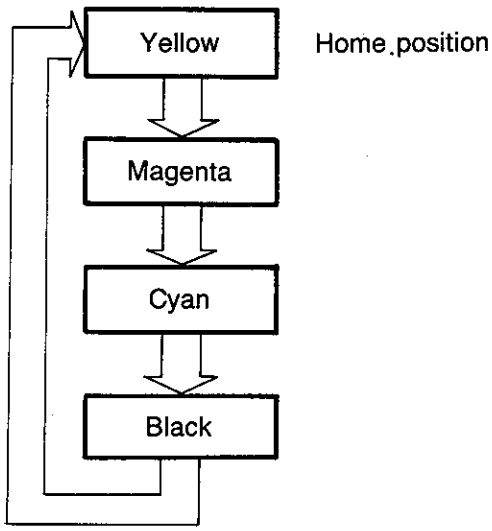
It is driven by +38 V application by the $\overline{\text{LF OVDV}}$ signal for line feed operation.



2.2.8 Bail open/close and color ribbon change

The bail/ribbon motor rotates clockwise to open and close the bail. It rotates in the reverse direction for color ribbon change.

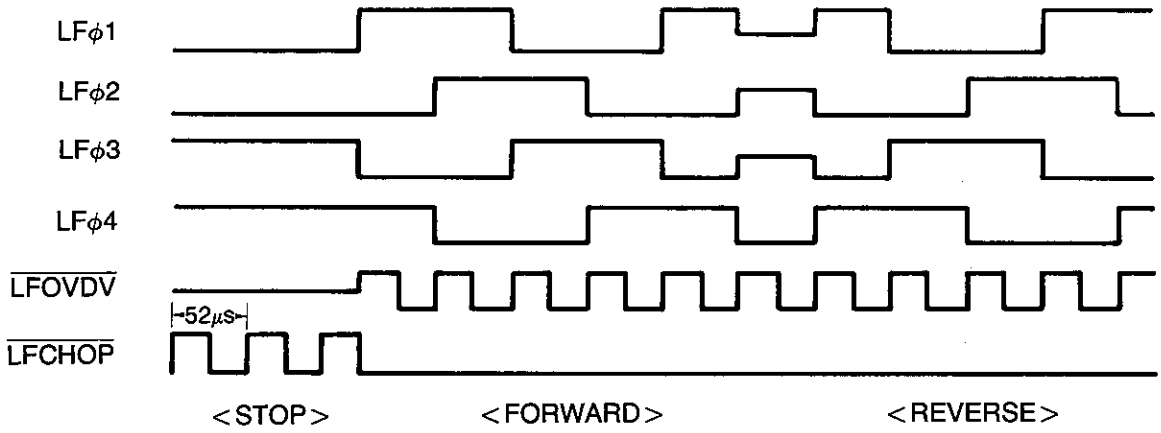
(1) Color ribbon change direction



2.2.7 Line feed

The LF motor is locked by the current supplied from +8 V according to the pulse duty of the $\overline{\text{LF CHOP}}$ signal during the stop period.

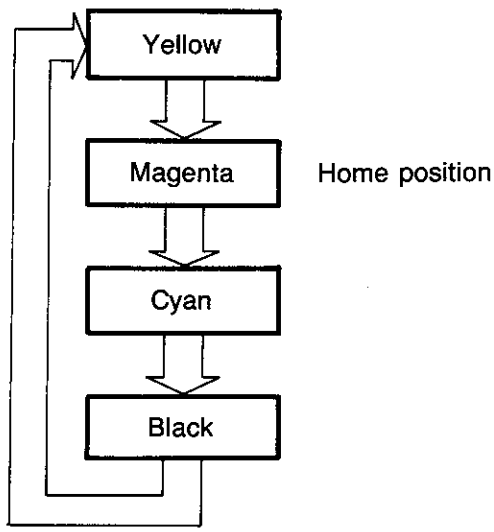
It is driven by +38 V application by the $\overline{\text{LF OVDV}}$ signal for line feed operation.



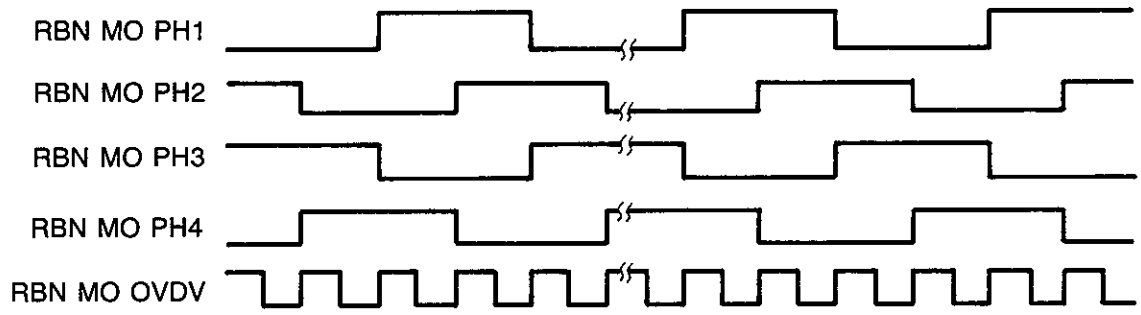
2.2.8 Bail open/close and color ribbon change

The bail/ribbon motor rotates clockwise to open and close the bail. It rotates in the reverse direction for color ribbon change.

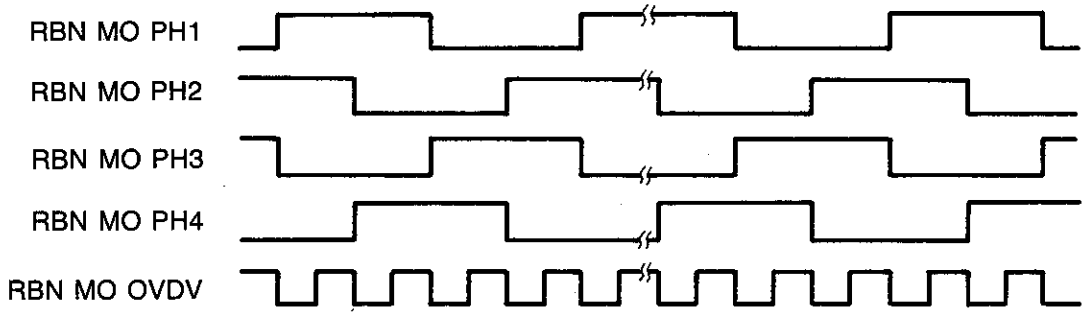
(1) Color ribbon change direction



(2) **Motor drive (bail open/close)**



(3) **Motor drive (color ribbon change)**



2.2.9 Alarm circuits

(1) Driver circuit abnormality detection alarm

This protective circuit prevents secondary troubles by stopping the power supply upon detection of an abnormality in the print head, LF motor or bail/ribbon motor driver circuit or in the peripheral circuit.

This circuit monitors the driving time by means of the signals (HDE ALM, HDO ALM, LF ALM and RBN ALM) connected to the overdrive signals for each driver circuit. If any driver circuit driving time exceeds the specified time, the ALM signal is output to switch off the power supply to stop all DC voltage outputs.

(2) Head high temperature alarm circuit

The thermistor built in the head monitors the head temperature for head coil protection.

If high duty printing continues for a long time, the head temperature rises. If it reaches a certain level (approx. 115°C — 125°C), head high temperature alarm 1 is detected to start one-way printing. When head temperature alarm 2 is detected, the printing operation is suspended to wait for the head temperature to fall. When the temperature falls to below the detection temperature, normal printing operation restarts.

As the head temperature rises, the resistance of the thermistor decreases and the potential of the positive input to the comparator (Q5) rises to invert the comparator. The $\overline{\text{HEAD ALM}}$ signal is then output and read by the master MPU via the I/O port of the LSI (Q13) to cause alarm 1 processing. The master MPU varies the comparator slice level according to the TEMP LEVEL signal. If the $\overline{\text{HEAD ALM}}$ signal is output, alarm 2 processing starts.

(3) Paper end detection circuit

Three photo sensors (continuous form end sensor, bottom paper end sensor and cut-sheet paper end sensor) are provided for different paper set routes to monitor paper end. When paper runs out, the corresponding sensor is turned off to input the CONTINUOUS form end, BOTTOM PE or CUT-SHEET PAPER END signal to the LSI (Q13) and is read by the master MPU. The master MPU stops the printing operation, informs the host of the paper end, and lights the alarm lamp.

(4) Cover open alarm circuit

When the front access cover is opened, the $\overline{\text{COV OPEN}}$ signal is input to the slave MPU from the interlocked cover open microswitch, and is then transferred to the master MPU. The master MPU stops the printing operation after the end of the printing of the current line, informs the host that receiving is impossible, and lights the alarm lamp.

2.2.10 Sheet Insertion Guide (SIG)

This printer allows temporary use of single sheets when the continuous form is used. It is not necessary to remove the continuous form, but retreat it to the push tractor position and use the single sheets. The first single sheet is automatically fed to the initial position.

Changing from continuous form printing to single sheet printing

State	Operation	Printer operation
SELECT	Press the TOF SET switch.	1. SELECT → DESELECT 2. The continuous form is fed backward until detection of the form end (max. 29 inch*) and held at the push tractor.
DESELECT	1. Set the release lever to the CLOSE side. 2. Insert the single sheet. 3. Press the FORM FEED switch.	1. The bail is opened. 2. The single sheet is fed to the initial position (1 inch from the leading edge.) 3. The bail is closed. 4. DESELECT → SELECT
SELECT		Printing on the single sheet is possible.

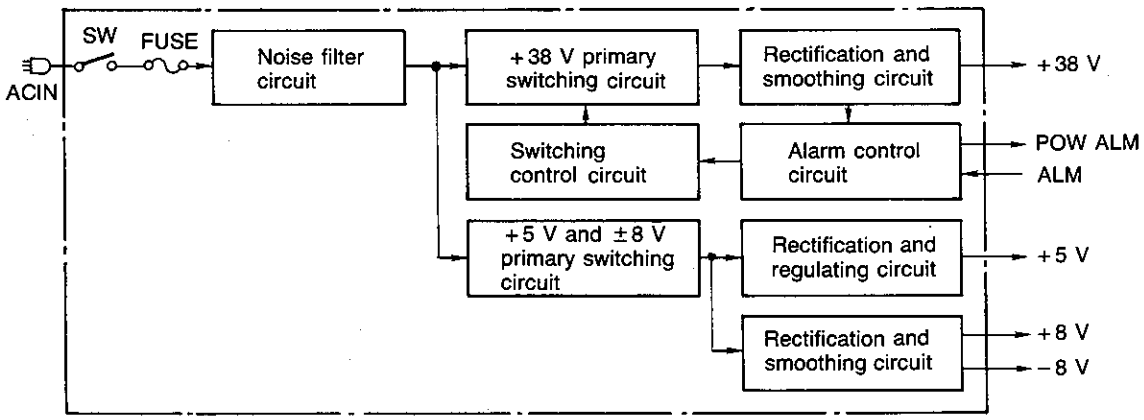
* If the form end is not detected after feeding backward by 29 inch, feeding stops with a JAM alarm. Press the SELECT switch to reset the alarm state.

Changing from single sheet printing to continuous form printing

State	Operation	Printer operation
SELECT	Press the SELECT switch, or wait until single sheet end detection.	SELECT → DESELECT
DESELECT	Press the FORM FEED switch, or continuously depress the LINE FEED switch.	Single sheet ejection
	1. Set the release lever to the OPEN side. 2. Press the FORM FEED switch.	1.The bail is opened. 2.The continuous form is fed to the initial position (1 inch from the leading edge.) 3.The bail is closed. 4.DESELECT → SELECT
SELECT		Printing on the continuous form is possible.

2.2.11 Power supply circuit

This switching type power supply circuit supplies the +5 VDC, ±8 VDC and +38 VDC.



The uses of output voltages and signals are described below.

Voltage/signal	Use
+5 V	Logic IC/LED drive voltage
+8 V	Serial interface line voltage and LF motor locking voltage
−8 V	Serial interface line voltage
+38 V	Print head, SP motor, LF motor and bail/ribbon motor drive voltage
POW ALM	Output from the power supply circuit upon detection of an abnormal temperature rise in the power supply circuit or an overcurrent of +38 V. The control unit suppresses the overcurrent by temporarily suspending printing. If the output does not change, the control unit sets alarm 60 (fan alarm).
ALM	Output from the main PCB upon detection of an abnormality in the print head, LF motor or ribbon/bail motor driver circuit, and stops the +38 V output.

3. EXPLANATION OF MECHANISM OPERATION

3.1 Print Head Mechanism and Operation (See Figures 3.1 and 3.2)

The print head is a spring charge type head using a permanent magnet, and is installed in the carriage moving in parallel with the platen.

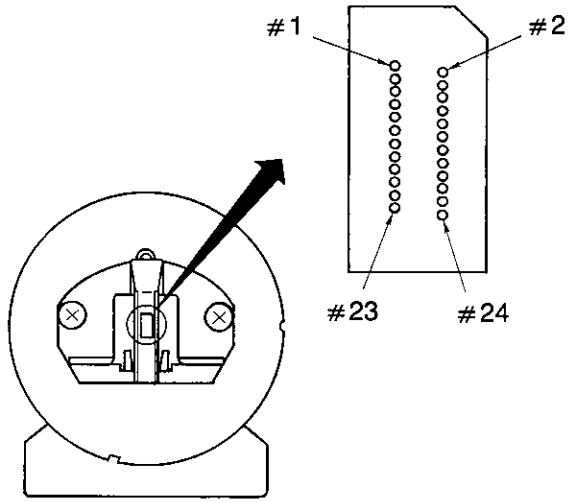


Figure 3.1 Print head pin arrangement
(View from the front end of print head)

(1) Print head operation

The armature is normally pulled to the core by the permanent magnet force against the armature spring force. The wire integrated with the armature is in the reset state. When the magnet coil is excited by the print command from the control unit, a flux in the reverse direction of the permanent magnet force is generated to cause the armature to move away from the core by the force of the armature spring. The wire strikes the platen with the ink ribbon and paper in between to effect printing.

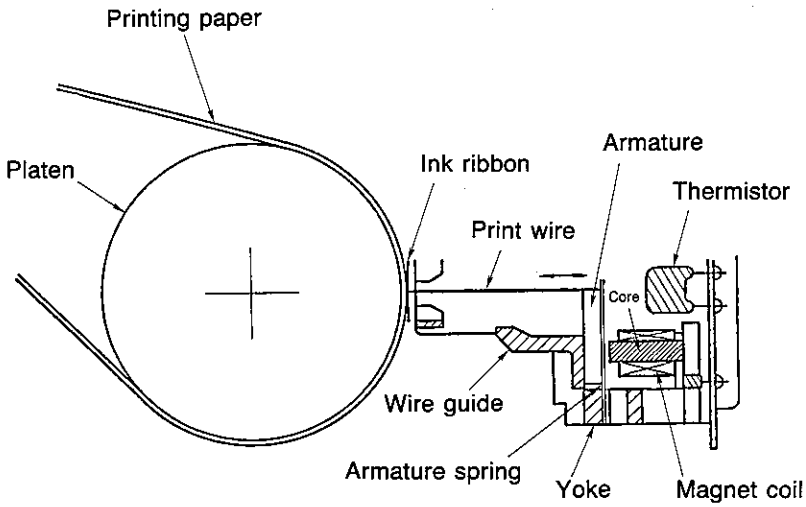


Figure 3.2

3.2 Spacing Mechanism and Operation

Spacing is effected by driving the main installed to the main shaft and slide beam set in parallel with the platen by the DC servo motor.

(1) Spacing operation (See Figure 3.3)

The carriage mounting the print head moves in parallel with the platen along the main shaft and slide beam. The carriage is fixed to the mini pitch belt under the carriage frame.

When the DC servo motor runs clockwise as viewed from its rear side, the driving force is transmitted to the mini pitch belt and the carriage moves from the left to the right. The DC servo motor rotating angle and speed are controlled by the count of ϕA and ϕB signals (with a phase difference of about 90°) from the encoder and the time intervals of the signals. The rotating direction is determined by the sign (positive or negative) of the phase difference between ϕA and ϕB.

The mechanism is designed so that the carriage moves 1.6 inches (40.64 mm) when the DC servo motor makes one revolution.

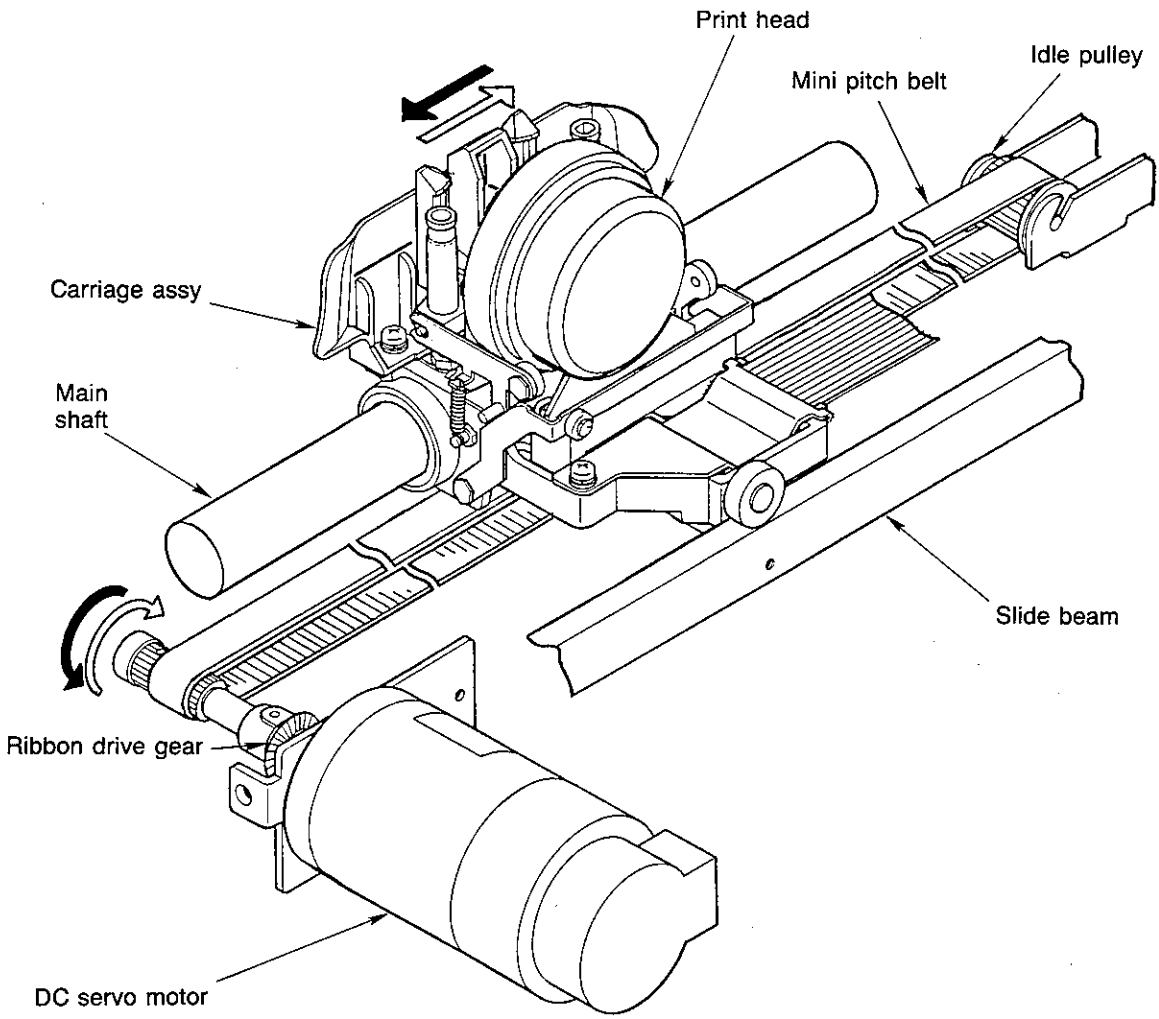


Figure 3.3 Spacing mechanism

3.3 Ribbon Feed Mechanism and Operation (See Figure 3.4)

The ribbon feed mechanism feeds the ribbon in synchronism with the spacing operation. The DC servo motor for spacing operation gives the driving force.

(1) Ribbon cartridge

A one-way feed endless ink ribbon is used to constantly obtain clear printing copy.

(2) Feed operation

The ribbon feed mechanism is driven as soon as spacing operation starts although no printing is made and stops after the end of the spacing operation. The space motor rotation is transmitted to the drive roller in the ribbon cartridge via the ribbon feed gear assembly to feed the ribbon.

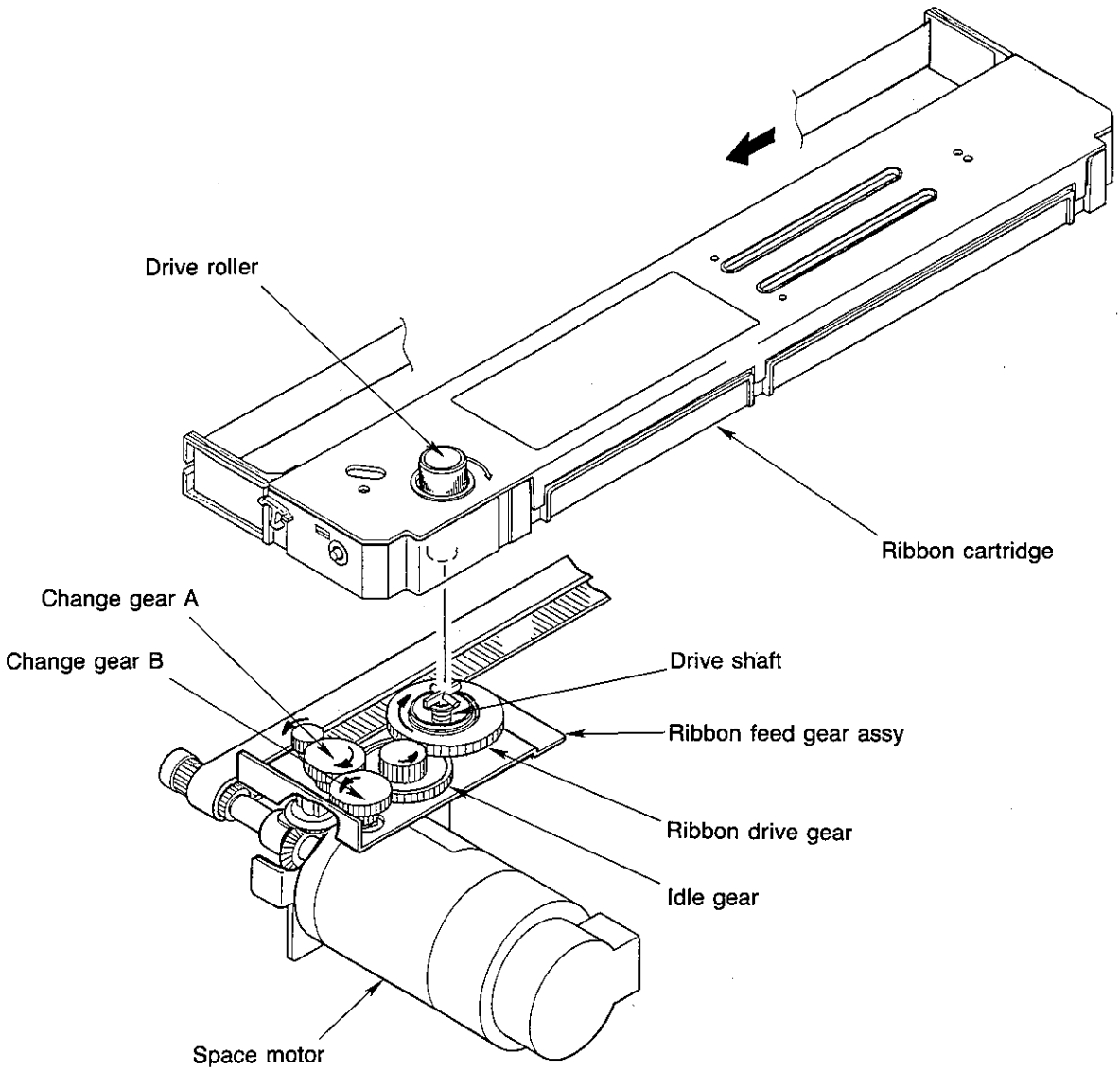


Figure 3.4 Ribbon feed mechanism

3.4 Head Gap Adjusting Mechanism and Operation (See Figure 3.5)

The head gap adjusting mechanism adjusts the gap between the platen and the print head.

This adjustment is necessary to obtain the proper head gap for varied paper thickness.

Adjustment is made with the head gap adjusting lever on the right side of the printer mechanism. The head gap changes as the eccentric cam fixed on both ends of the main shaft rotates.

The adjustment is in 9 stages (1 to 9).

When the paper (for example, copying paper) requires adjusting lever position 3 or more, the print head is driven with increased force to improve printing quality. When the adjusting lever is set to position 3 or more, it presses the micro switch which detects the lever position.

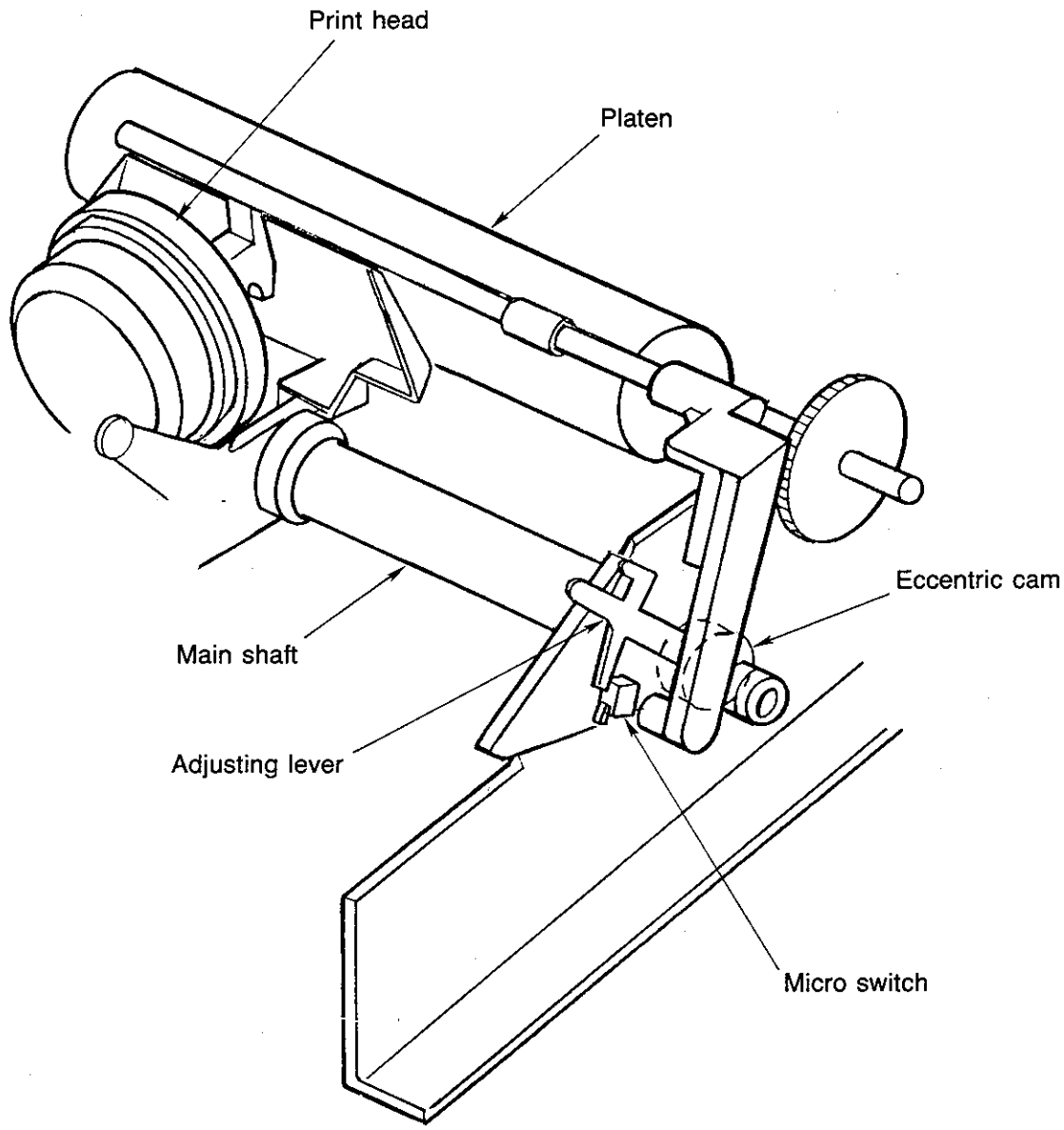


Figure 3.5 Head gap adjusting mechanism

3.5 Paper Feed Mechanism and Operation

Line feeding of the printing paper is driven by the LF motor to feed the platen and pin tractor.

(1) **Single sheet feeding mechanism (See Figure 3.6)**

The LF motor for paper feeding is installed on the left side frame. The motor rotation is transmitted to the platen via the platen pulley.

The mechanism is designed to feed the paper by 0.17 inch (4.23 mm) when the stepping motor rotates 60 steps. The minimum feed rate is for one step of the LF motor or 0.03 inch (0.07 mm).

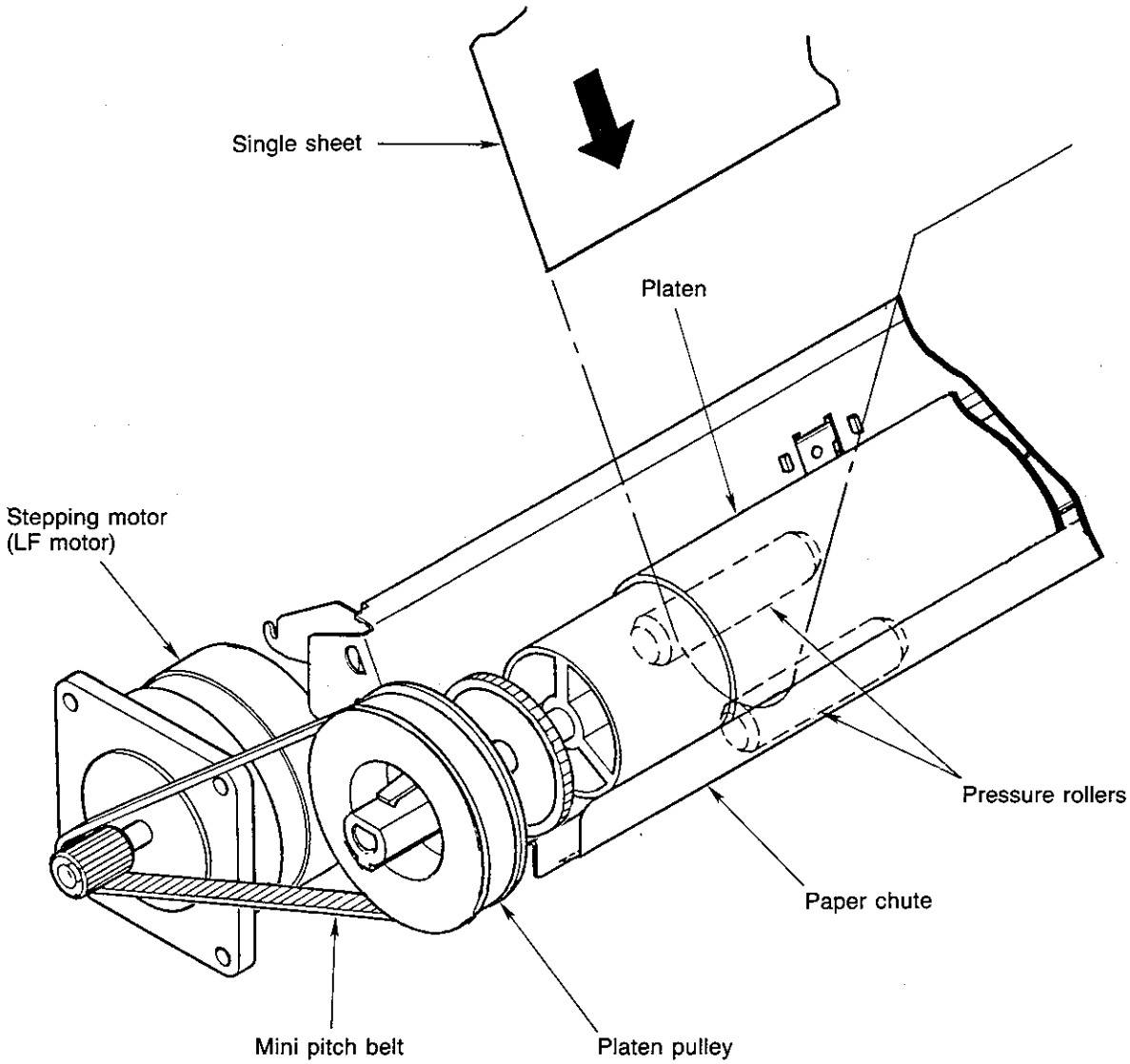


Figure 3.6 Single sheet feeding mechanism

(2) **Continuous form feeding mechanism (See Figure 3.7)**

The power transmitted to the platen as described in (1) (single sheet feeding operation) rotates drive gears A and B by way of the platen gear at the right end of the platen and the idle gear.

As drive gears A and B rotate, the pin wheels and pin tractor belts are rotated via two sheet feeder shafts to cause the continuous form to be fed.

In the push tractor method, the form can be cut at about 1 inch after the end of printing.

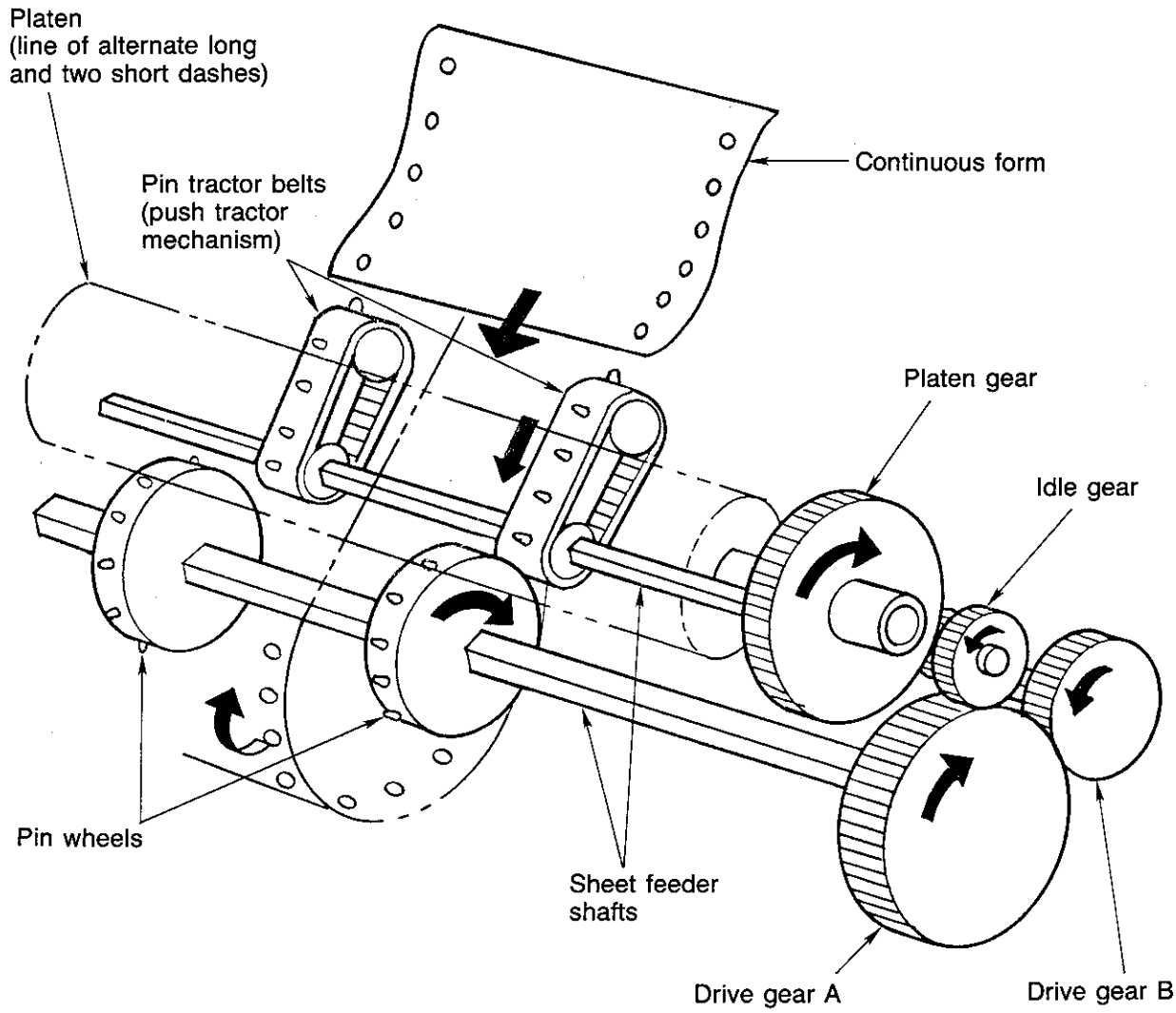


Figure 3.7 Continuous form feeding mechanism

(3) **Single sheet and continuous form selection mechanism (See Figure 3.8)**

Selection between the single sheet and continuous form is made by using the paper release lever on the right side of the printer mechanism.

Push the paper release lever backward. The idle gear is raised toward the front and the driving force transmission from the platen gear to drive gears A and B is disconnected, so the pin tractors interlocked with drive gear B are kept stopped.

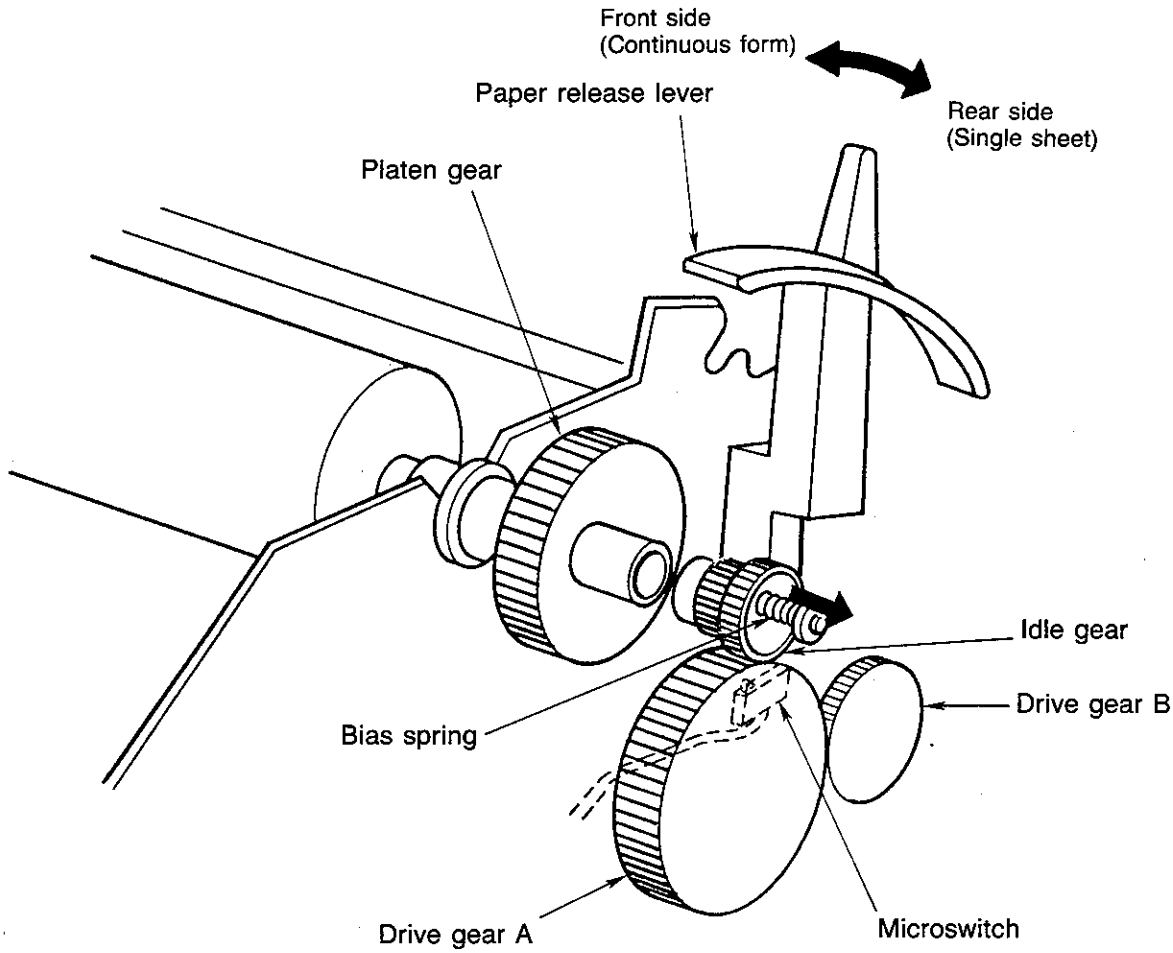


Figure 3.8 Single sheet and continuous form selection

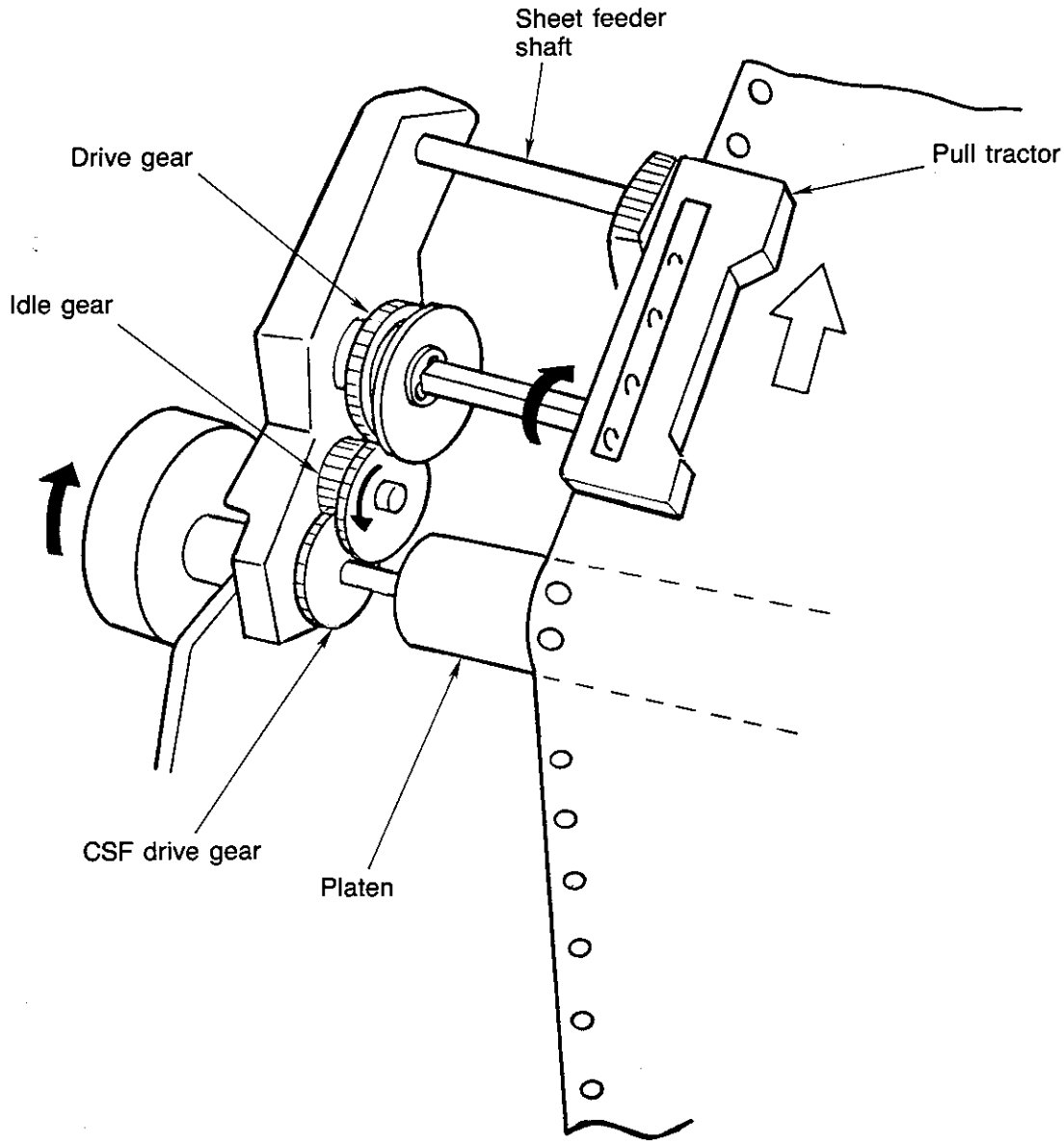
As a result, the single sheet is fed by platen rotation but the continuous form on the pin tractors is not fed.

When the paper release lever is pulled forward, the idle gear is forced to the bias spring and moves in the reverse direction of the arrow. Therefore, platen gear rotation is transmitted to drive gears A and B to cause feeding of the continuous form.

A microswitch is installed under the paper release lever to detect the paper release lever set position. It is used for the control of paper feeding in automatic loading.

(4) Pull tractor mechanism (Option) (See Figure 3.9)

When the optional pull tractor unit is installed, continuous form feeding in the bottom paper path is possible.



The rotation of the platen is transmitted to the idle gear of the pull tractor unit via the CSF drive gear at the left end of the platen. The idle gear rotation is then transmitted to the pull tractor unit drive gear to rotate the pull tractor via the sheet feeder shaft to feed the continuous form.

Figure 3.9 Pull tractor mechanism

(5) **Push-pull tractor mechanism (Option) (See Figure 3.10)**

This mechanism consists of the optional pull tractor mechanism and the standard push tractor mechanism.

This mechanism is used for forward and reverse feeding of the continuous form by setting it to the push and pull tractor mechanisms.

The platen pulley rotation is transmitted to the push tractor mechanism and pull tractor unit to cause form feeding at these two places. Actually the operations described in (3) and (4) above are carried out concurrently. Adjustment to eliminate slackness on the push and pull tractor mechanisms is necessary before starting continuous form feeding.

When the drive gear is pushed leftward (in the direction of the black arrow ⬅), the drive gear and idle gear are disengaged to rotate only the pin tractor in the pull tractor. This makes it possible to eliminate the slackness of the form.

After adjustment is completed, the spring force pushes the drive gear to the right in the direction of the white arrow ⇨) to reengage it with the idle gear, thus enabling form feeding.

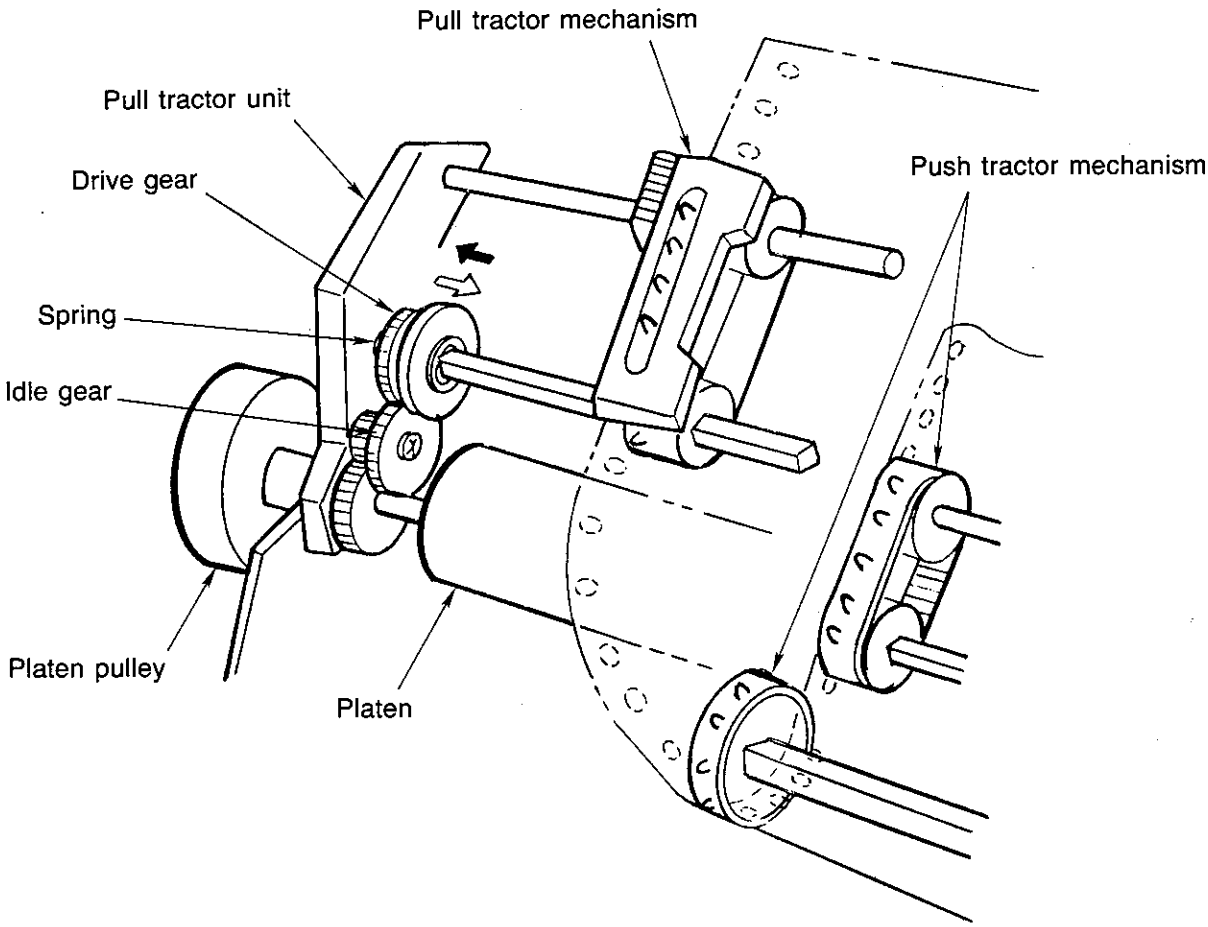


Figure 3.10 Push-pull tractor mechanism

3.6 Paper End Detection Mechanism (See Figure 3.11)

(1) **Rear form end detection mechanism** (when the form with sprocket holes is used)

The form prevents the paper end lever tip end from coming into the hole on the sheet feeder cover rib and the microswitch is set to the ON state. When the form runs out, the paper end lever comes into the hole on the sheet feeder cover rib and the bottom of the paper end lever leaves the microswitch to turn it off for form end detection. The form end state is detected when the remaining form length from the printing position is down to 5.78 inches (147 mm).

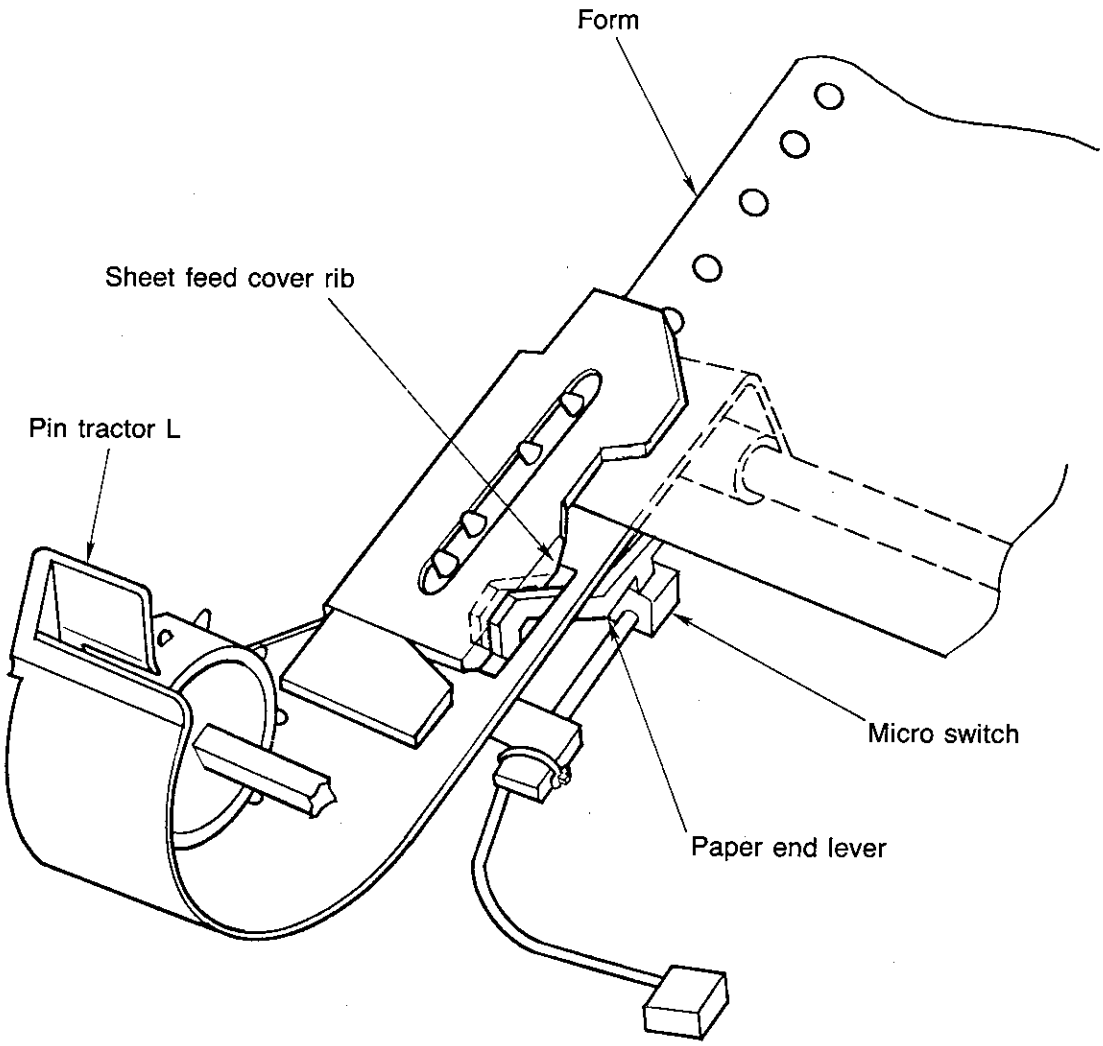


Figure 3.11 Rear form end detection mechanism

(2) **Bottom paper end detection mechanism (See Figure 3.12)**
(When optional pull tractor unit is used)

When the paper exists, the paper prevents the tip end of the bottom paper end lever from coming into the hole on the main frame and the sensor is in the ON state. When the paper runs out, the bottom paper end lever comes into the hole on the main frame. At the same time, the other end of the bottom paper end lever shields the sensor to provide the OFF state for bottom paper end detection. The bottom paper end is detected when the remaining paper length from the current printing position becomes approx. 2.36 inches (60 mm).

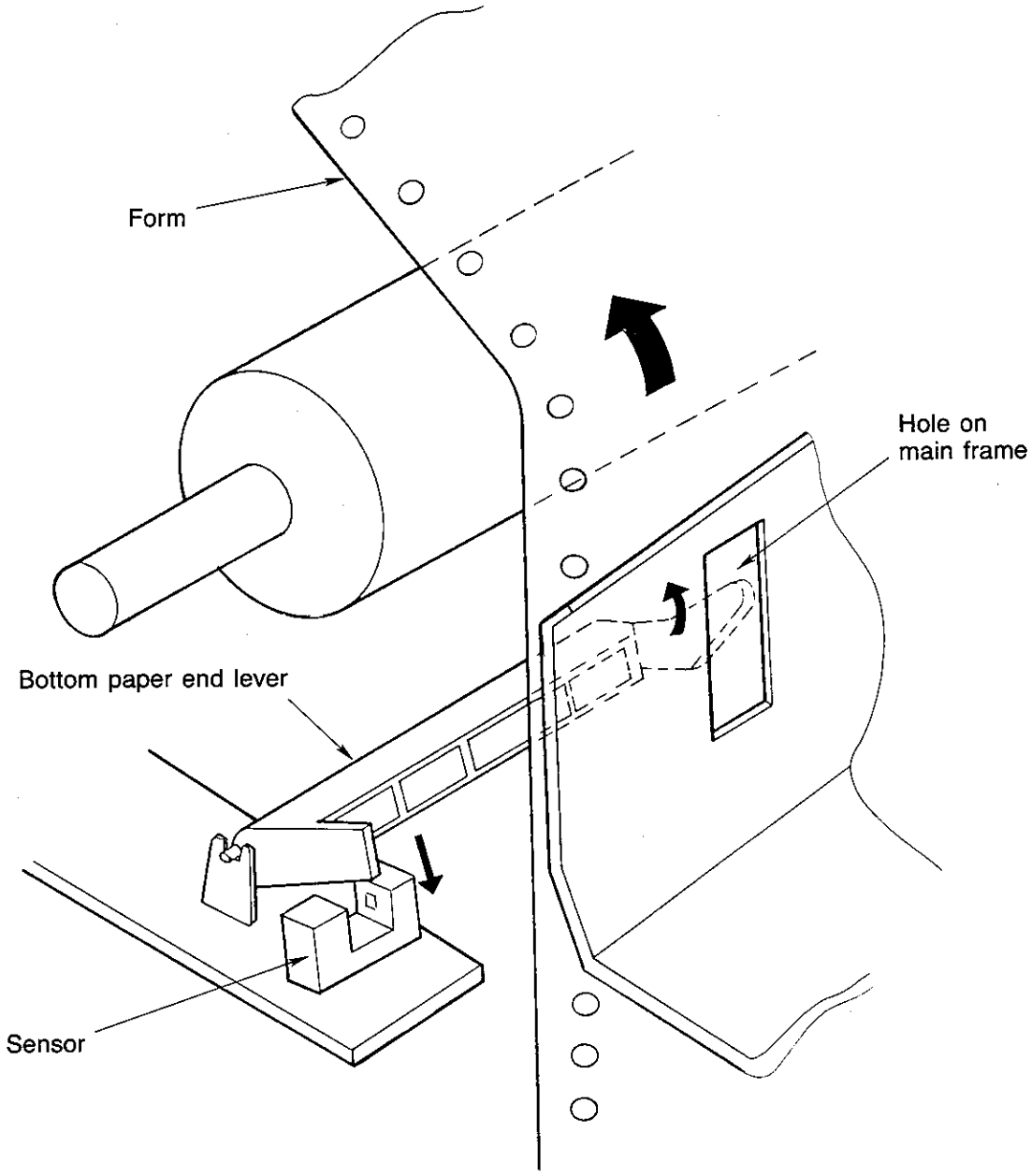


Figure 3.12 Bottom paper end detection mechanism

3.7 Paper Bail Open Mechanism (See Figure 3.13)

This mechanism is interlocked with the SIG function described in section 2.2.10.

The paper bail may be opened and closed manually, but this printer also has an automatic bail open/close mechanism. When the SIG function operates, continuous form or single sheets are loaded automatically, and the bail is opened and closed automatically.

The paper bail is normally pushed to the platen by the spring force.

The drive system consisting of the bail motor, idle gear and bail cam are provided on the left side of the printer mechanism.

When the bail open command is sent from the switch on the operation panel or from the control unit, the bail motor starts and the bail gear is rotated via the idle gear. The bail gear has the bail open cam. As the bail gear rotates, the bail arm moves away from the platen against the spring tension.

When the bail close command is sent from the control unit, the bail motor restarts to rotate further in the same direction and the bail arm is closed.

The sensor is located on the sensor board under the bail arm to detect whether the bail arm is in the opened position or closed position.

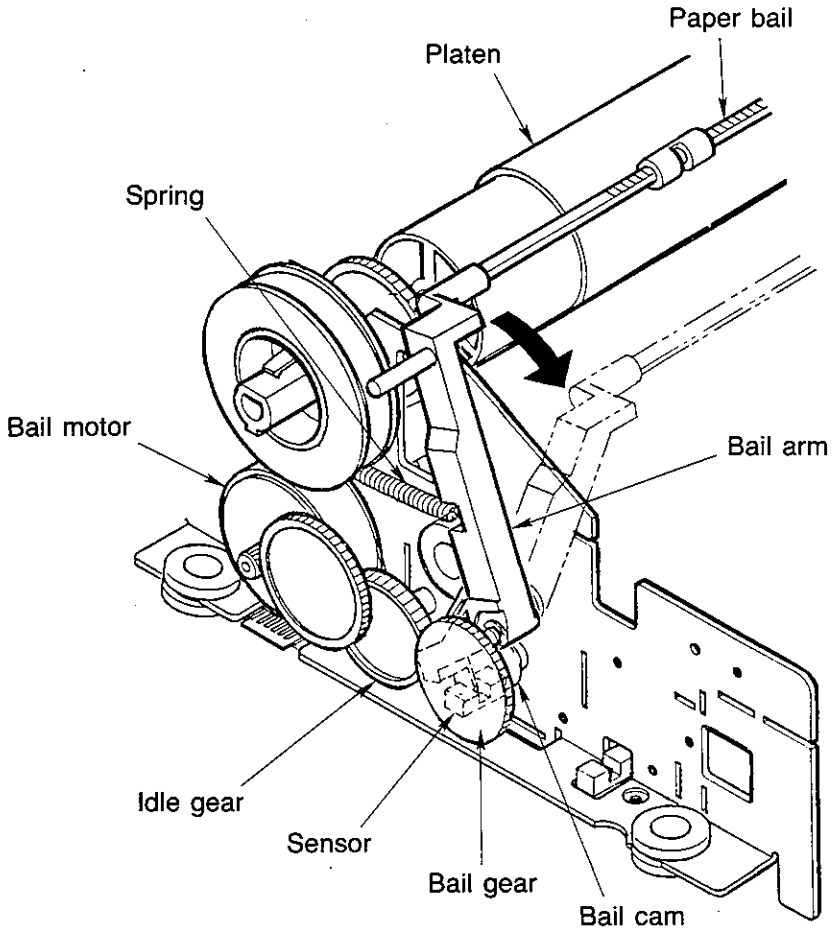
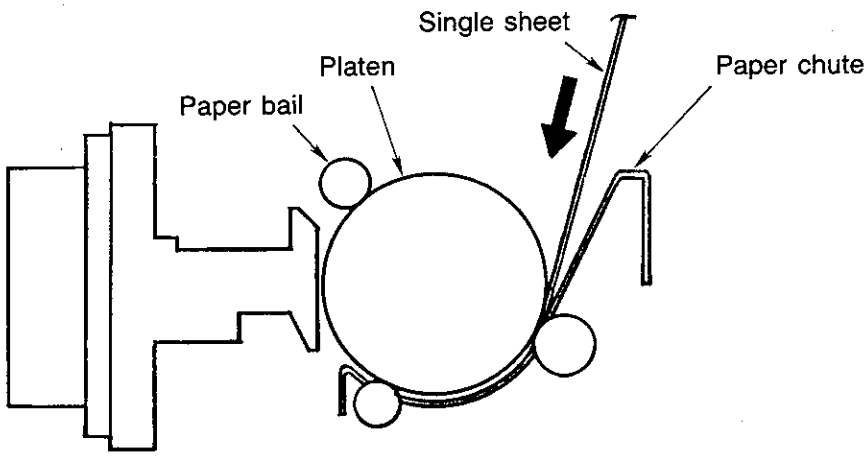


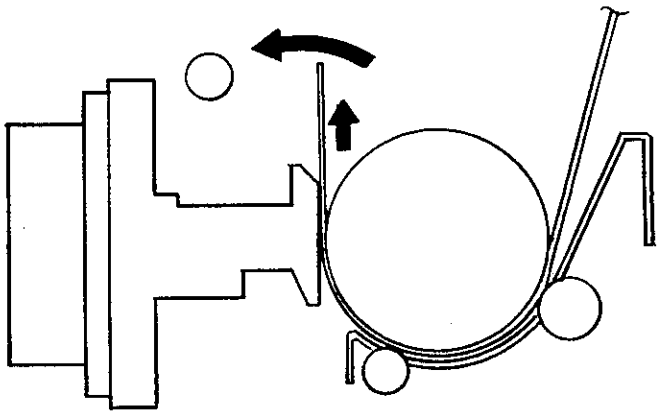
Figure 3.13 Paper bail open mechanism

The sequence of automatic paper loading by the paper bail open mechanism is explained for the single sheet.

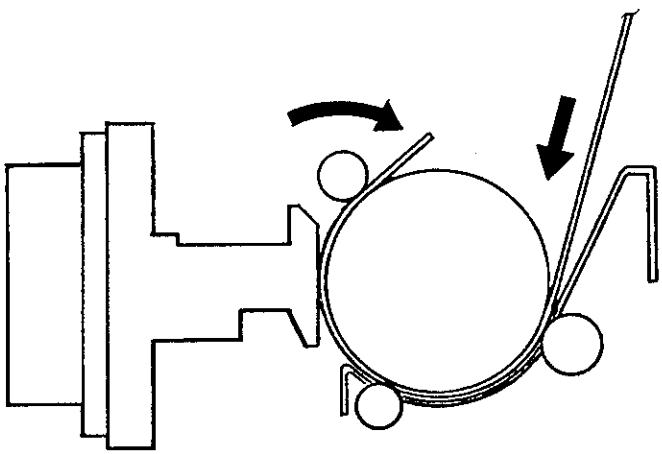
(1) Set the paper lock release lever to the close position and set the single sheet in the paper chute.



(2) When the FF switch on the operation board is pressed, the paper bail is automatically set to the open position. Here, the sheet is fed for a fixed length.



(3) The paper bail is automatically closed.



3.8 Color Ribbon Change Mechanism (See Figure 3-14)

This mechanism selects the ribbon color. It works as the rotation of the bail motor vertically shifts the ribbon guide installed on the carriage as well as ribbon cartridge installed on the printer frame.

At the ribbon change command, the bail motor starts rotating which is transmitted to the ribbon shift gear via the idle gear and the bail gear, and then to the ribbon shift cam via the coaxial one-way clutch.

A single rotation of the ribbon shift cam gives two stages of shift. Each color is stopped at when the ribbon cartridge and the ribbon guide is climbing up.

The ribbon shift cam rotation gives the ribbon cartridge bracket vertical transposition the location of which is transmitted to the shift arm by the roller lever for control of the ribbon guide.

A sensor detecting the ribbon cartridge and the ribbon guide location is placed on the lower sensor board of the ribbon shift cam.

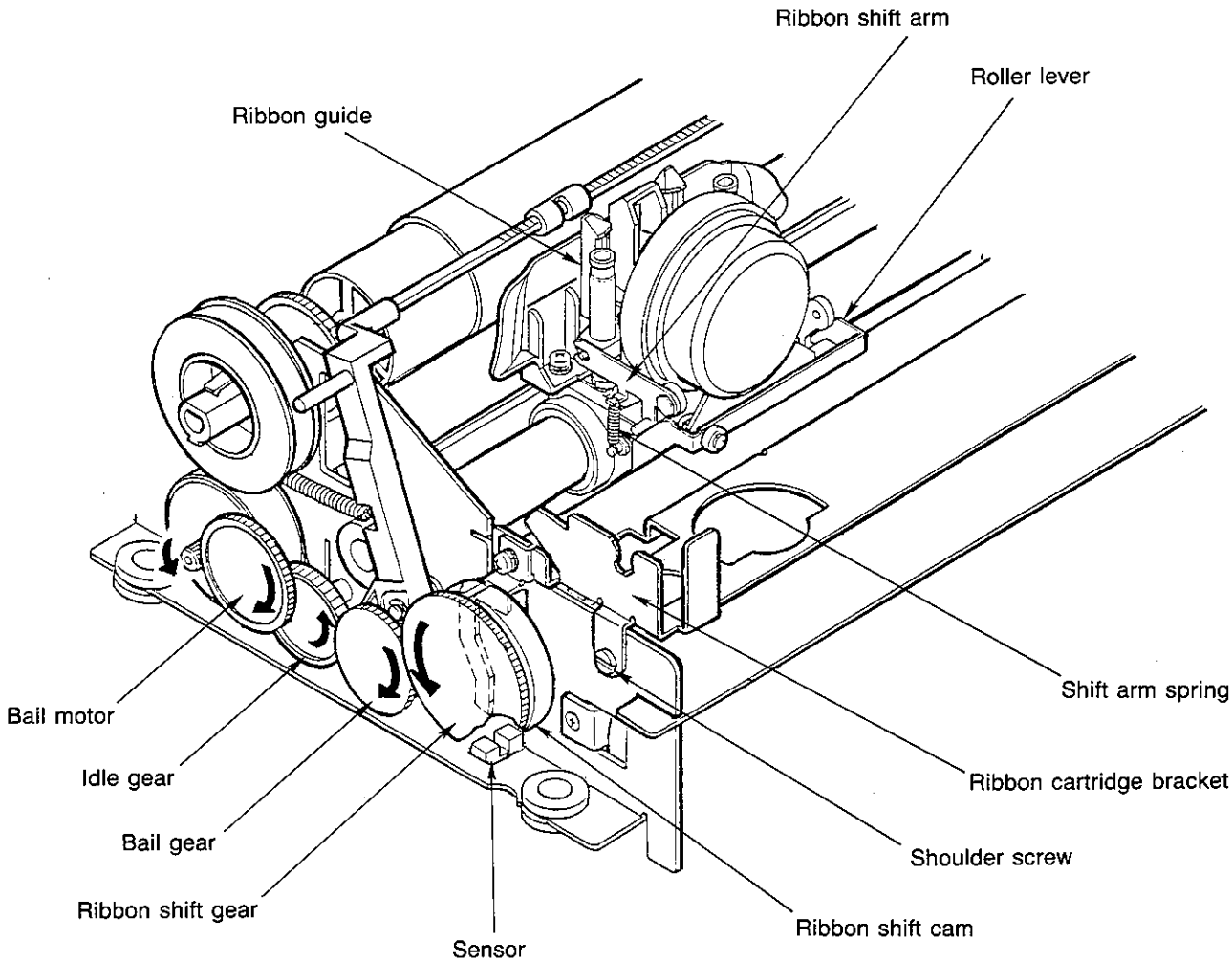


Figure 3.14 Color Ribbon Change Mechanism

B. MENU ITEM

NOTE: Factory settings are bold printed.

Menu Item	Selections
Lines Per Inch	**6**, 8
Emphasized	Yes, **No**
Enhanced	Yes, **No**
Character Width	**Single**, Double, Triple
Character Height	**Single**, Double, Triple
Italics	Yes, **No**
Slashed Zero	**Yes**, No
Language Set	**USA**, French Canada, France, Germany, UK, Denmark I, Denmark II, Sweden I, Italy, Spain I, Spain II, Latin America, Japan, Norway, Netherlands, Sweden II, Sweden III, Sweden IV
Graphics Print	**Unidirectional**, Bidirectional
Page Length	3, 3.5, 4, 5.5, 6, 7, 8, 8.5, 11, 11-2/3, **12**, 14
Color (ML393C only)	Black Ribbon, Black, Yellow, **Magenta**, Cyan, Violet, Orange, Green
Select # of DLL character sets	0, **1**, 2
DC1/DC3 active	**Yes**, No
Skip Over Perforation	Yes, **No**
Auto LF	Yes, **No**
Paper Out Override	Yes, **No**
Print Registration	+5, +4, +3, +2, +1, **0**, −1, −2, −3, −4, −5
Form Tear Off	**1-1/12″**, 11/12″
*Menu Line	**6**, 1
*Slashed Letter O	Yes, **No**
Character Set	**Epson**, IBM Set I, IBM Set II

Note: *ODG only.

The following items appear on the menu only when the serial interface is selected:

Parity	Odd, Even, **None**
Serial Data 7/8 Bits	7, **8**
Protocol	**Ready/Busy**, X-ON/X-OFF
Diagnostic Test	Yes, **No**
Busy Line	**SSD-**, SSD+, DTR, RTS
Baud Rate	19.2, **9.6**, 4.8, 2.4, 1.2, 0.6, 0.3
DSR Signal	**Valid**, Invalid
DTR Signal	Ready On Select, **Ready On Power Up**
Busy Time	**0.2**, 1

B. MENU ITEM

1. EPSON Emulation

NOTE: Factory settings are bold printed.

Menu Item	Selections
Lines Per Inch	**6**, 8
Emphasized	Yes, **No**
Enhanced	Yes, **No**
Character Width	**Single**, Double, Triple
Character Height	**Single**, Double, Triple
Italics	Yes, **No**
Slashed Zero	**Yes**, No
Language Set	**ASCII**, French Canadian, French, German, British, Danish I, Danish II, Swedish I, Italian, Spanish I, Spanish II, Latin American, Japanese, Norwegian, Dutch, Swedish II, Swedish III, Swedish IV, Turkish, Swiss I, Swiss II
Graphics Printing	**Unidirectional**, Bidirectional
Page Length	3, 3.5, 4, 5.5, 6, 7, 8, 8.5, 11, 11-2/3, **12**, 14
Color (monochrome printer)	**Black Ribbon**, Film Ribbon
Color (color printer)	Black Ribbon, Black, Yellow, **Magenta**, Cyan, Violet, Orange, Green, Film Ribbon
Select # of DLL character sets	0, **1**, 2
DC1/DC3 active	**Yes**, No
Skip Over Perforation	Yes, **No**
Auto LF	Yes, **No**
Paper Out Override	Yes, **No**
Print Registration	+5, +4, +3, +2, +1, **0**, −1, −2, −3, −4, −5
Form Tear Off	11/12 inch, **1-1/12 inch**
Menu Line	1, **6**
Slashed Letter O	Yes, **No**
Character Set	**Epson**, IBM Set I, IBM Set II

The following items appear on the menu only when the serial interface is selected:

Parity	Odd, Even, **None**
Serial Data 7/8 Bits	7, **8**
Protocol	**Ready/Busy**, X-ON/X-OFF
Diagnostic Test	Yes, **No**
Busy Line	**SSD-**, SSD+, DTR, RTS
Baud Rate	19.2, **9.6**, 4.8, 2.4, 1.2, 0.6, 0.3
DSR Signal	**Valid**, Invalid
DTR Signal	Ready On Select, **Ready On Power Up**
Busy Time	**0.2**, 1

B. MENU ITEM

2. IBM Emulation

NOTE: Factory settings are bold printed.

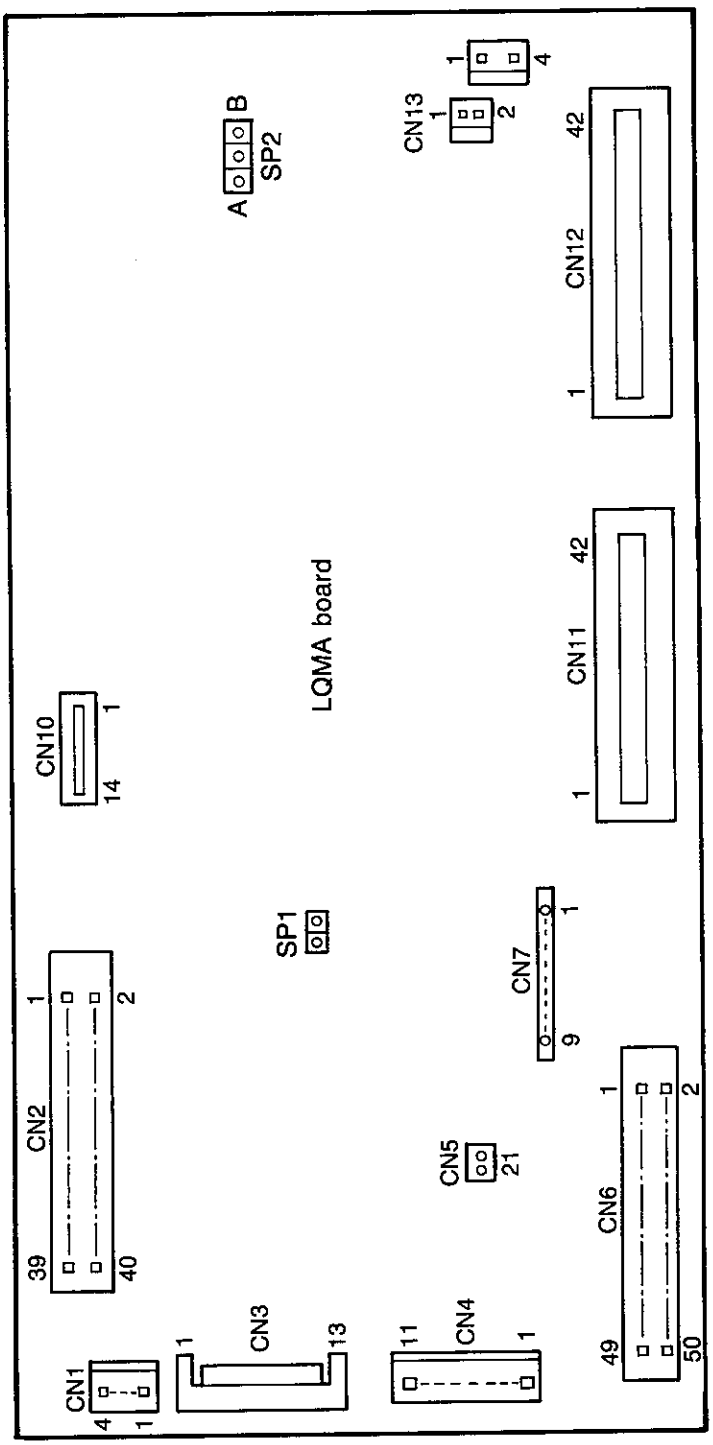
Menu Item	Selections
Lines Per Inch	**6**, 8
Emphasized	Yes, **No**
Enhanced	Yes, **No**
Character Width	**Single**, Double, Triple
Character Height	**Single**, Double, Triple
Italics	Yes, **No**
Slashed Zero	**Yes**, No
Language Set	**ASCII**, British, German, French, Swedish I, Danish, Norwegian, Dutch, Italian, French Canadian, Spanish, Swedish II, Swedish III, Swedish IV, Turkish, Swiss I, Swiss II
Graphics Printing	**Unidirectional**, Bidirectional
Page Length	3, 3.5, 4, 5.5, 6, 7, 8, 8.5, 11, 11-2/3, **12**, 14
Color (monochrome printer)	**Black Ribbon**, Film Ribbon
Color (color printer)	Black Ribbon, Black, Yellow, **Magenta**, Cyan, Violet, Orange, Green, Film Ribbon
Select # of DLL character sets	0, **1**
Skip Over Perforation	Yes, **No**
Auto CR	Yes, **No**
Auto LF	Yes, **No**
Paper Out Override	Yes, **No**
Print Registration	+5, +4, +3, +2, +1, **0**, −1, −2, −3, −4, −5
Form Tear Off	11/12 inch, **1-1/12 inch**
Emulation Mode	**ASCII**, Alternate Graphics Mode
Menu Line	1, **6**
Slashed Letter O	Yes, **No**
Character Set	Set 1, **Set 2**
Code Page Option	**USA**, Multilingual, Norway, Portugal, Turkey, Greek-928*, Greek-851*, Greek-437*

* Appears only when Greek option cartridge is installed.

The following items appear on the menu only when the serial interface is selected:

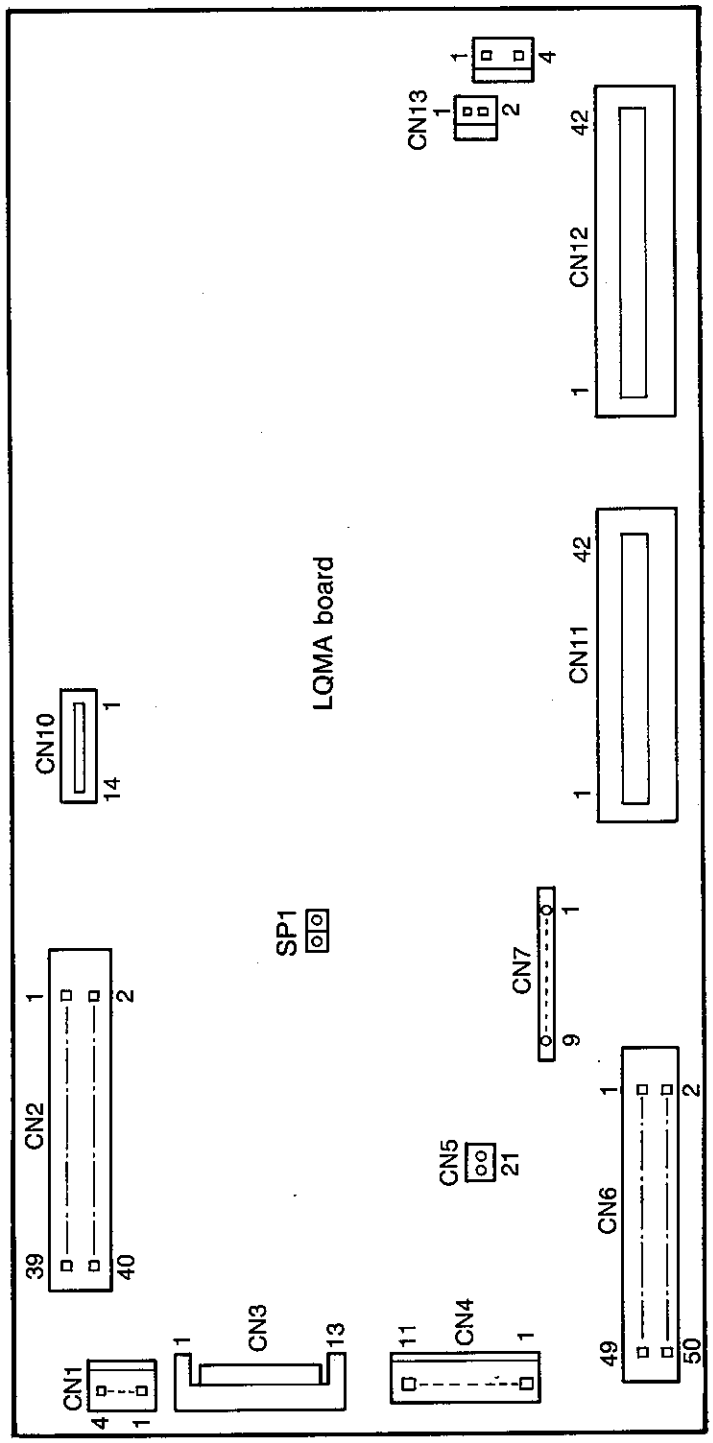
Parity	Odd, Even, **None**
Serial Data 7/8 Bits	7, **8**
Protocol	**Ready/Busy**, X-ON/X-OFF
Diagnostic Test	Yes, **No**
Busy Line	**SSD-**, SSD+, DTR, RTS
Baud Rate	19.2, **9.6**, 4.8, 2.4, 1.2, 0.6, 0.3
DSR Signal	**Valid**, Invalid
DTR Signal	Ready On Select, **Ready On Power Up**
Busy Time	**0.2**, 1

C. CONNECTOR PIN AND SHORTING PLUG ARRANGEMENT

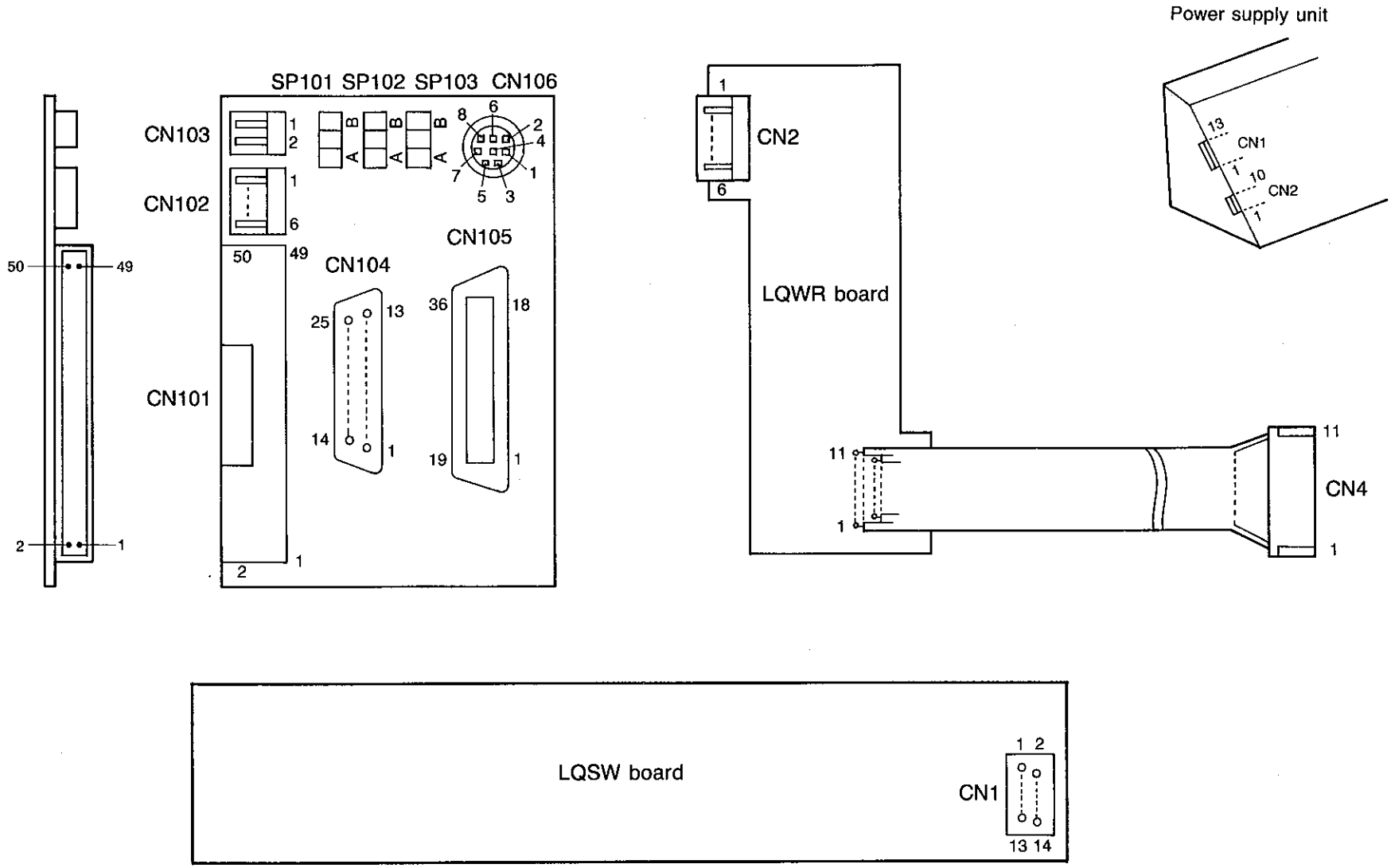


Note 1. Setting of SP1
Open: Sets the printer for exclusive use of black ribbon
Short: Sets the printer for color model
2. Setting of SP2
A side shorted: Mask ROM in CPU(Q11) is used.
B side shorted: External ROM (Q15) is used.
3. This arrangement applies to PCBs of version 8 and succeeding versions.

C. CONNECTOR PIN AND SHORTING PLUG ARRANGEMENT

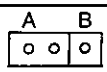
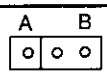


Setting of SP1
Open: Sets the printer for exclusive use of black ribbon
Short: Sets the printer for color model


SP101 SP102 SP103 CN106
CN103
CN102
CN101
CN104
CN105
CN2
LQWR board
Power supply unit
CN1
CN2
CN4
LQSW board
CN1

D. SHORTING PLUG FUNCTION TABLE

The settings of shorting plugs 101, 102, and 103 are shown below.

Setting / Shorting plug	 Set to A side	 Set to B side
SP101	AUTO FEEDEX signal of Centronics I/F is made valid.	AUTO FEEDEX signal of Centronics I/F is made invalid.
SP102	I-PRIME signal of Centronics I/F is made valid.	I-PRIME signal of Centronics I/F is made invalid.
SP103	+5 V is output to pin 18 of Centronics I/F.	+5 V is not output to pin 18 of Centronics I/F.

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